Plates. { Drawings of Jenney and Mundie.
Drawings of R. Clipston Sturgis.

THE BRICKBVILDER

DEVOTED TO THE INTERESTS OF

ARCHITECTVRE IN MATERIALS OF CLAY

PUBLISHED MONTHLY.

85 WATER STREET, BOSTON, MASS.

VOLVME FIVE

SEPTEMBER MDCCCXCVI

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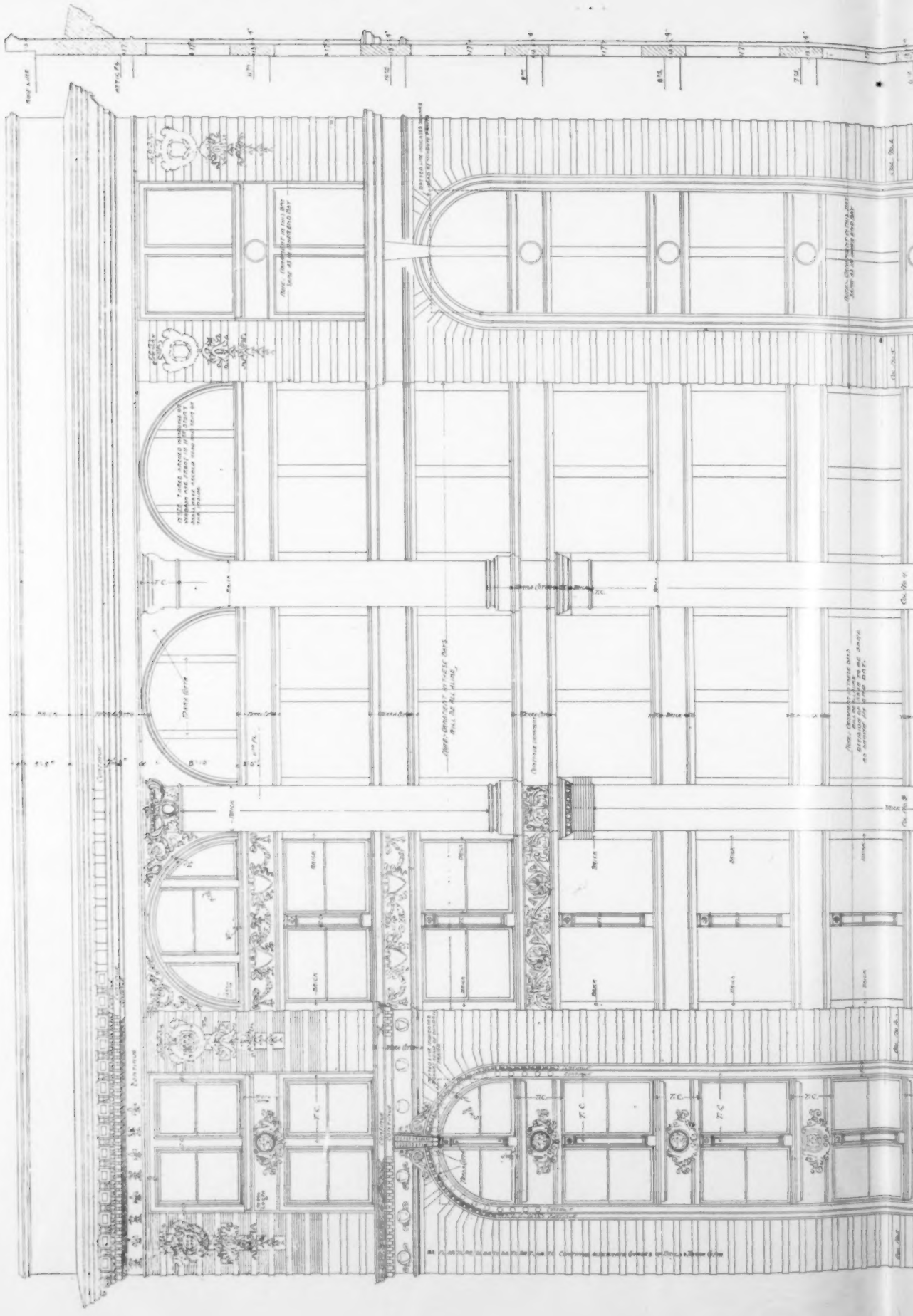

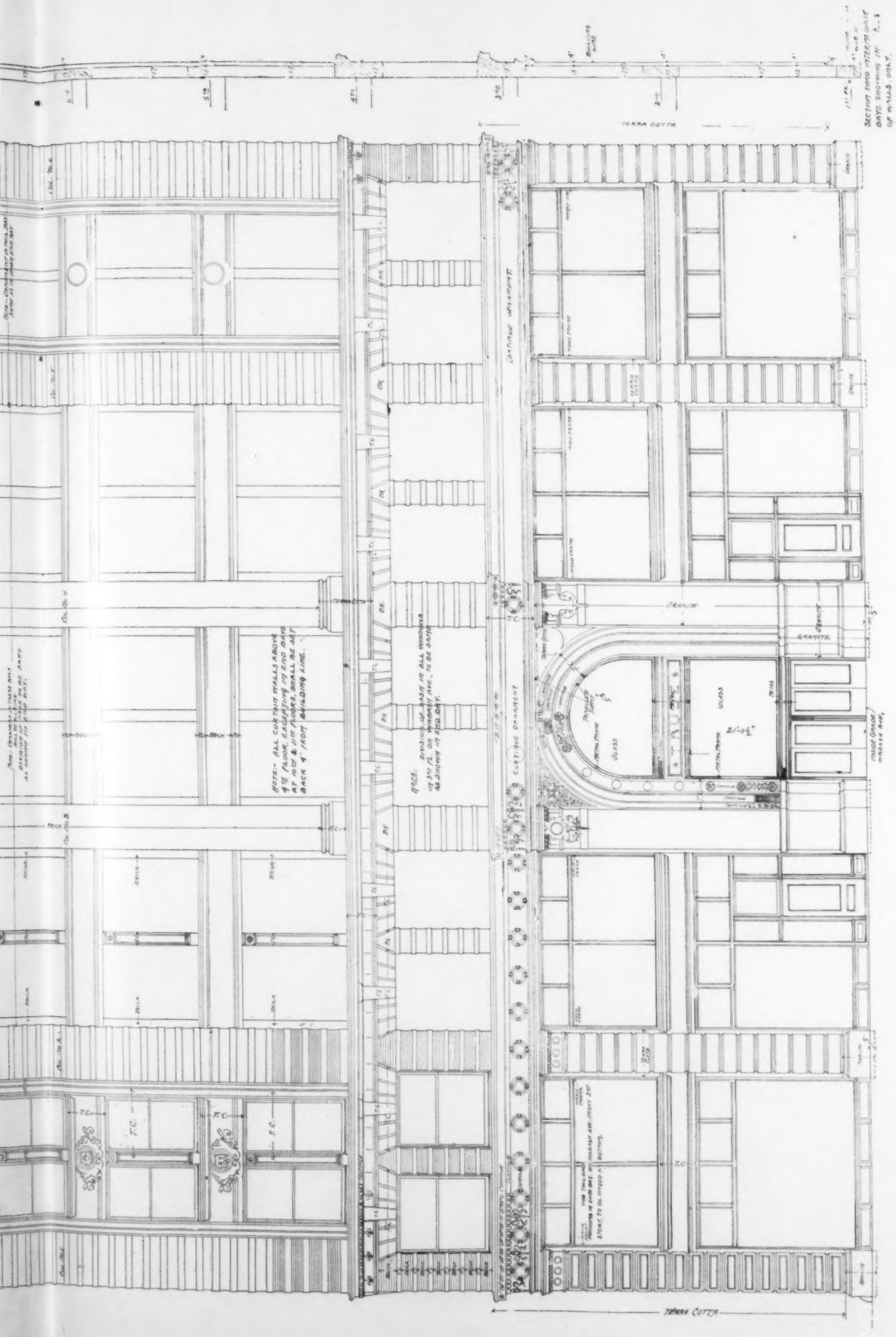

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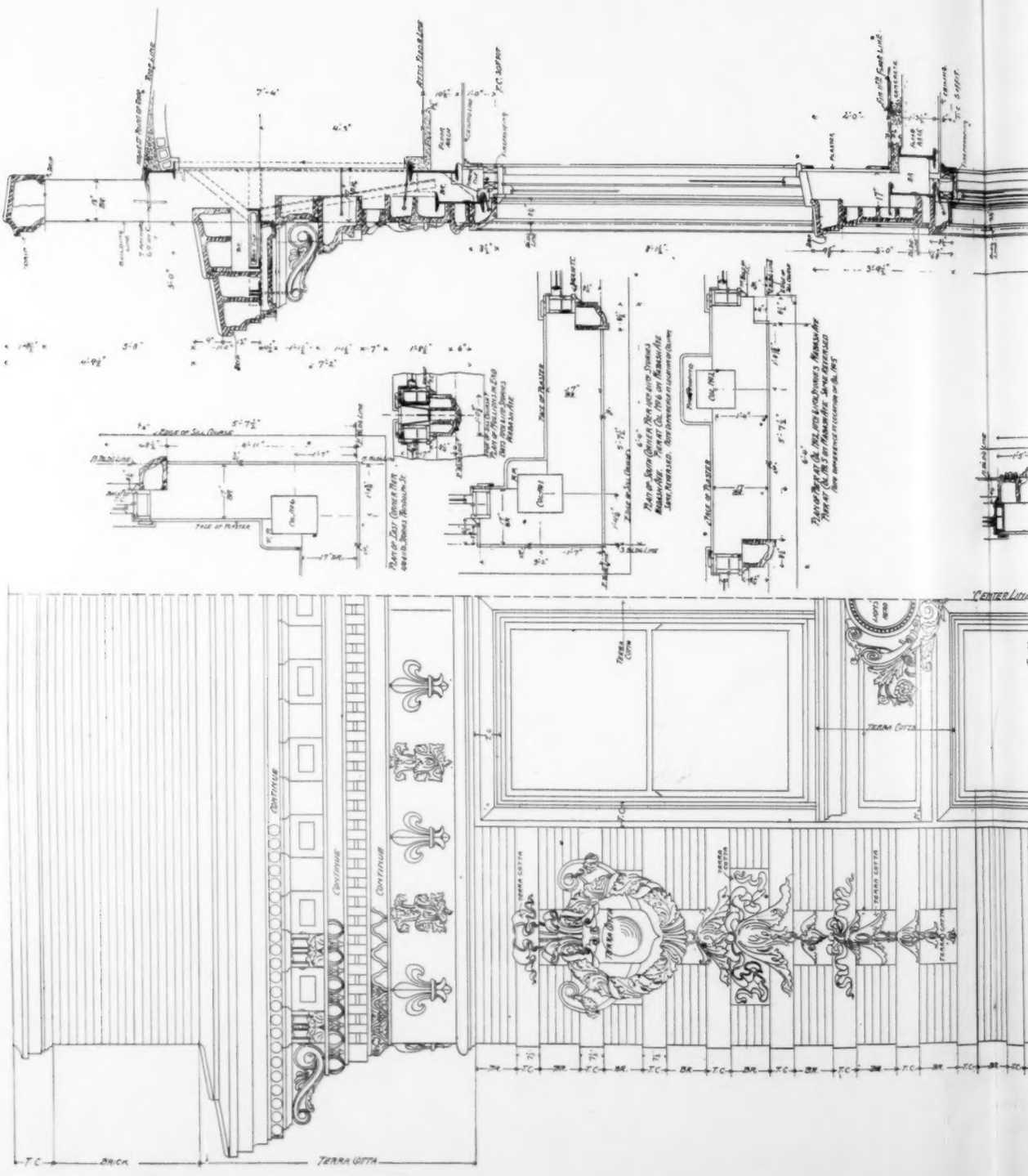
TRUDE BUILDING, CHICAGO.—WABASH AVENUE ELEVATION.

JENNEY & MUNDIE, ARCHITECTS.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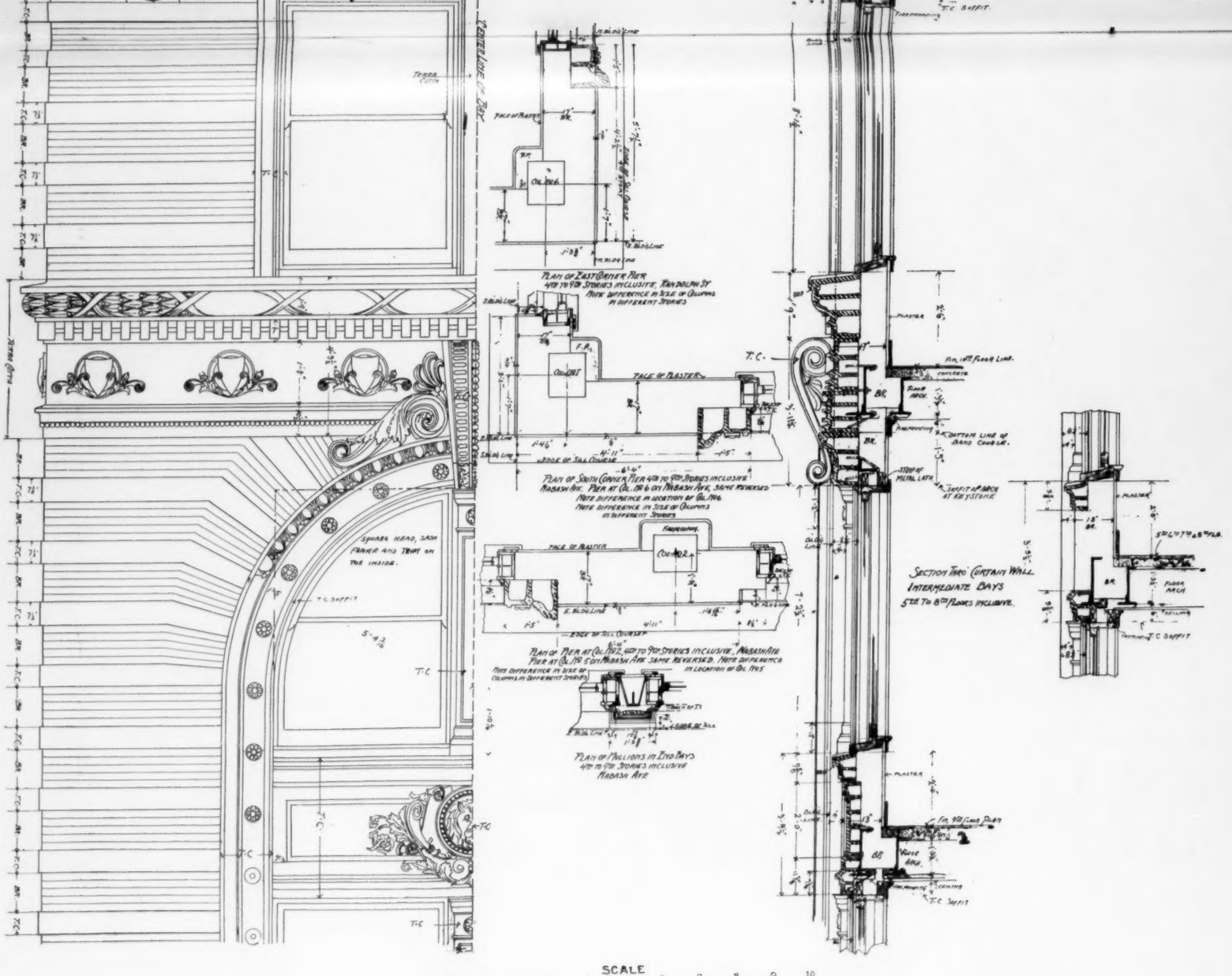

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JENNEY & MUNDIE, ARCHITECTS.

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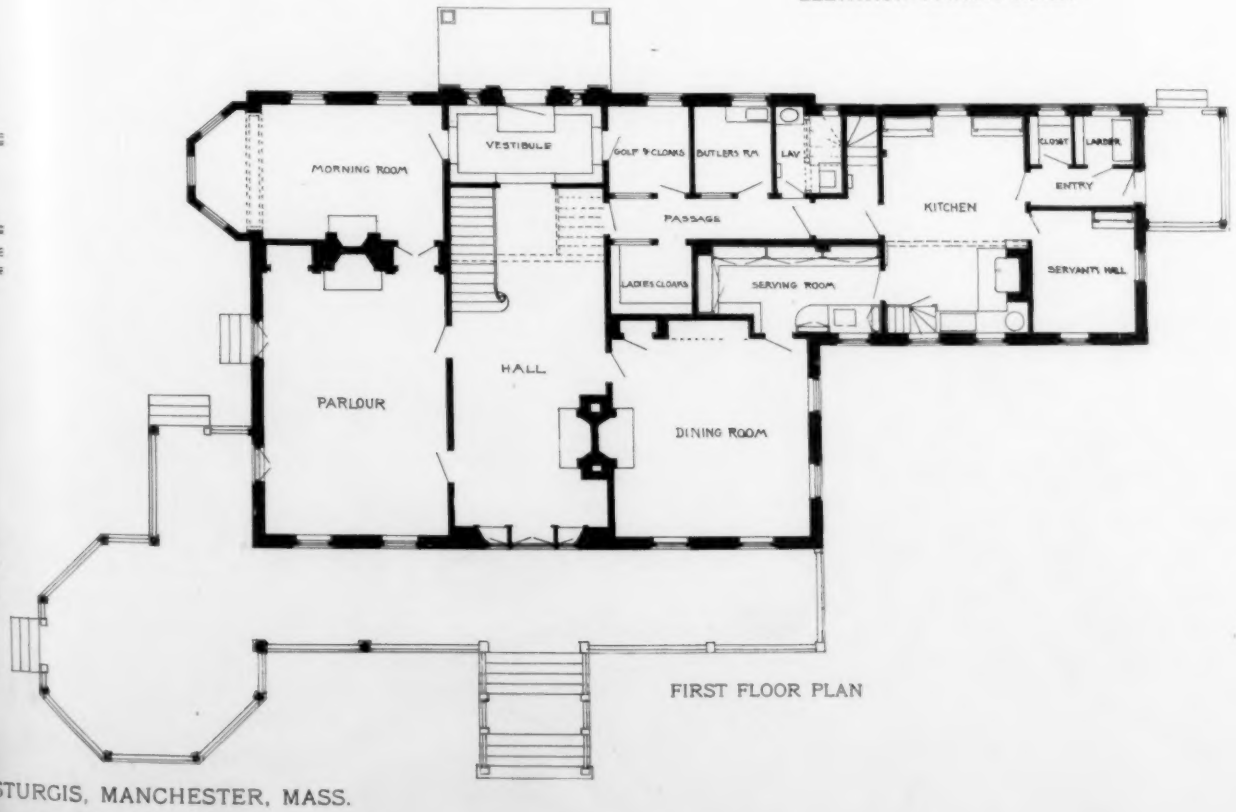
SCALE

BRICK RESIDENCE FOR MRS. JOHN H. ST
R. CLIPSTON STURGIS.

PLATES 53 and 54.

ELEVATION TOWARD SEA.

ELEVATION TOWARD ROAD.



FIRST FLOOR PLAN

JOHN H. STURGIS, MANCHESTER, MASS.

JOHN STURGIS, ARCHITECT.

VOLVME V SEPT. 1896 No. 9

THE BRICKBVILDER

OFFICE 85 WATER STREET BOSTON

THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

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IMITATION IN BUILDING MATERIALS.

THE essential characteristic distinction between a design which is to be executed in terra-cotta and one which is to be executed in stone is not always easily maintained. The distinction, however, is a vital one and is thoroughly appreciated by an educated architect. The illustrations which we have published in connection with Mr. Marquand's articles on the Della Robbia work are good examples in point. No one looking at these shrines or frames would ever think of them as being constructed in any material but terra-cotta. Although the moldings are manifestly similar to those which are used in other materials, and the motives of decoration are precisely the same in some cases, yet when it comes to the touch, to the spirit of the design, we know at once that it was intended to be wrought in terra-cotta and in nothing else. There is every evidence that the artist-craftsmen and architects of the early Italian Renaissance period were keenly sensitive to fitness of material for its intended use, but the distinction is too often forgotten in modern work. The architecture of to-day is so largely retrospective and borrows so lavishly from every preceding epoch, that with the abundance of good photographs illustrating all of the great works of the past, it is no wonder the architect sometimes loses sight of the niceties which should be observed in their correlation to the material employed; and the use of the burnt clay products for the best class of work being in a certain sense a relatively modern revival, terra-cotta is sometimes characterized as being only an imitation in a cheaper material of the forms which are derived from stone architecture.

In one sense all the architecture of the present period is imitative. There are certain general forms, motives, moldings, and details which appertain to architecture in the broader sense, irrespective of material, being within vaguely defined but perfectly appreciated limits eminently proper for execution in terra-cotta, stone, iron, wood or plaster; and being applied in one medium does not imply copying from another. Indeed, the charge might very easily be turned the other way and the statement made that stone work is very often imitated from terra-cotta designs. What architect has not sometimes longed to copy in stone the delicate terra-cotta work of such buildings as the Certosa Monastery at Pavia, work which is essentially and fundamentally nothing but terra-cotta in its character? We have seen even some of the Della Robbia shrines copied line for line in wood, which is a more unjustified translation than if they were to be carved in stone. The spirit of imitation is so inground in our architectural traditions that it is small wonder we sometimes fail to observe the fitness of form in its relation to material; and yet, on the whole, we are inclined to believe that there is less of this false simulation in terra-cotta work than in any other material. It is comparatively rare to find a terra-cotta building which gives one the impression of being constructed in stone. The necessary difference in the jointings, the facilities with which some contours and shapes can be executed in the plastic material, and the fact that others have to be avoided entirely of necessity make it really difficult to strictly imitate a stone effect in brick and terra-cotta; and notwithstanding the charge which can, we admit, with certain justice, be charged against some of the work, we believe that, on the whole, the burnt clay arts are on a properly recognized artistic basis, and the tendency is every year more and more to emphasize the particular expression, and to make more manifest the actual fitness of the material to the design.

Just in what consists this fitness it is almost impossible to exactly define. It is a matter of sentiment and feeling rather than of concrete form. If any one doubts this, let him try the very simple experiment of deliberately executing a molding or piece of carving first in stone and then in terra-cotta. Even when the attempt is made to produce an identical effect, the result will be nearly always entirely different. To borrow our motives, and in a general way our sense of detail, from stone, wood, or what not, is perfectly legitimate so long as we give the result the character of the chosen material; and the thoughtful designer who appreciates the possibilities as well as the limitations of terra-cotta, and will stand over his work in the modeling as well as on the drawing table, has not the slightest difficulty in making terra-cotta manifestly true to itself.

It has been said that the newer shades of brick and terra-cotta have been designed by our manufacturers and adopted by our architects with a view to reproducing as closely as possible the effect of a stone building without being obliged to pay the cost. This we deny entirely. We do not believe that the element of cost alone has ever determined the selection of face brick instead of stone when the choice has rested with a thoroughly trained architect. Good brick and terra-cotta need no such plea for their existence, and the fact that we have a hundred or more shades of terra-cotta and brick at command where formerly there were but two or three, and that this variety will enable us to give a tone to our buildings which is similar to the tone given by some kinds of stone, simply enlarges the resources at the architect's command, but does not in any sense imply

that the sole object in using colored brick or terra-cotta is to simulate the effect of a particular stone. To a certain extent color can almost be said to be independent of the material, and if a deep neutral tint is required to produce a certain effect on a building, it by no means follows that we should feel obliged to use stone for that purpose simply because the corresponding tone in brick is an artificial product, and resembles what nature has done with stone. We are afraid of color, we use it timidly, and when we dare to use even colored stone, we do it with a sort of reluctant apology that nature made the color, and therefore it must be all right. But nature has given us also the means of coloring our brick and terra-cotta, and producing shades which are entirely beyond the reach of any stone quarry, and it is not imitation to the slightest extent when we can improve upon the crude raw material of nature. We are not saying that the burnt clay products are necessarily superior to stone for building material. Each has its place, and there is room in the world enough for all, but the burnt clay products have the advantage of plasticity, the wider range of color, and greater ease of manipulation, and the imitation of stone effects which has been urged as a defect in some of our recent terra-cotta work springs from incidental effects rather than from any deliberate intent.

THE special prizes offered in The Barta Press Competition have been awarded by Mr. Barta to the following contestants: —

Wm. E. Restieaux,	Columbus, Ohio.
Wm. P. Bausmith,	Cincinnati, Ohio.
Joseph Wig, Jr.,	Chicago, Ill.
Paul G. Hentz,	Dayton, Ohio.
Elmer Grey,	Milwaukee, Wis.
Henry M. Stillman,	Milwaukee, Wis.
Wm. Leslie Welton,	Boston, Mass.
Ernest A. Van Vleck,	Ithaca, N. Y.
Peter Brust,	St. Francis, Wis.
F. S. Swales,	Rochester, N. Y.
Eddy Fairchild, Jr.,	Dayton, Ohio.
James C. Green,	West Orange, N. J.
L. Eugene Jallade,	New York City.
Gilbert F. Crump,	Rochester, N. Y.
Chas. G. Bachmann,	Allentown, Penn.
O. J. Danernhein,	St. Louis, Mo.
J. P. Daly,	Boston, Mass.

ILLUSTRATED ADVERTISEMENTS.

HARTFORD is preeminent as the headquarters of insurance institutions, and the business connected with them has long been regarded as the staple industry of the city. The Hartford Fire Insurance Company are just now adding an extra story to their premises, and extending it along Trumbull Street. The present building is a massive granite structure, but the new portions are being done in terra-cotta, which has been made a very close match for the granite, not only in color, but in surface texture. The hart, or red deer, is associated with the arms of the city, and the head has been worked into the ornament on panels in the new extension. Cady, Berg & See are the architects, and the terra-cotta is being supplied by the New York Architectural Terra-Cotta Company.

IN the advertisement of Charles T. Harris, lessee of the Celadon Terra-Cotta Company, page xxvi, is illustrated a bungalow at Monument Beach, Mass. George H. Gardner, Esq., owner. Willard T. Sears, Boston, architect.

SOCIETY AND PERSONAL NOTES.

MR. CHARLES F. SCHWEINFURTH, architect, has removed to the New England Building, 129 Euclid Avenue, Cleveland.

MR. WILLIAM H. ABBOTT, JR., whose office is at 19 Broadway, New York City, is at present making a tour of England sketching and studying the old English style of architecture.

ON Monday evening, September 21, the Chicago Architectural Club held its first meeting since the vacation season. The hosts of the evening were Messrs. Frank M. Garden, Edward F. Garden, and Hugh M. G. Garden.

THE following-named gentlemen have been chosen as a Jury of Selection and Hanging Committee for the coming architectural exhibition by the T Square Club of Philadelphia, which is to be held at the Pennsylvania Academy of the Fine Arts in connection with the Sixty-sixth Annual Exhibition of Painting and Sculpture opening in December, 1896.

WALTER COPE, *Chairman.*
EDGAR V. SEELER.
LOUIS C. HICKMAN.
DAVID K. BOYD.
WM. L. PRICE.
ADIN B. LACEY, *Secretary.*
Room No. 77 Brown Bros. Building.
JOHN M. CARRERE,
Pres. Society of Beaux Arts Architects.
ROBERT D. ANDREWS,
Pres. Boston Architectural Club.
ALBERT KELSEY,
Pres. Philadelphia T Square Club.

MAXIMS FOR DRAFTSMEN.

THE power of shading rightly depends mainly on lightness of hand and keenness of sight; but there are other qualities required in drawing dependent not only on lightness, but steadiness of hand; and the eye, to be perfect in its power, must be made accurate as well as keen, and not only see shrewdly, but measure justly.

Nearly all expression of form, in drawing, depends on your power of graduating delicately; and the graduation is always most skillful which passes from one tint to another very little paler.

In darkness of ground there is the light of the little pebbles or dust; in darkness of foliage, the glitter of the leaves; in the darkness of flesh, transparency; in that of stone, granulation; in every case there is some mingling of light.

An entire master of the pencil or brush ought, indeed, to be able to draw any form at once, as Giotto his circle; but such skill as this is only to be expected of the consummate master, having pencil in hand all his life, and all day long; hence, the force of Giotto's proof of his skill.—*Ruskin.*

Practical Schools of Brick Design.

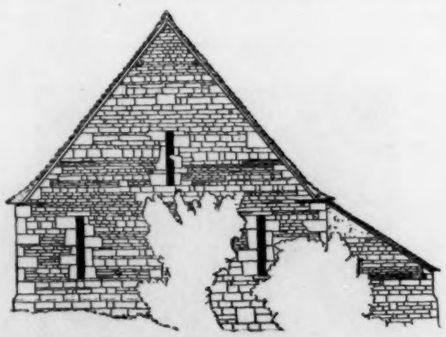
BY ROBERT D. ANDREWS.

ANY one who has traveled much in Europe, and made good use of his eyes, knows that there are to be seen among the old buildings many delightful ways of employing brick with which our masons are not familiar. If the architect wishes to make use of any of these treatments of brick design in his practice to-day, he finds himself in a hard position. The difficulty is to convey his knowledge to the man who has to do the work. If, on the one hand, an architect were himself handling the trowel, or if, on the other, the mason had only seen the original work, all might be well; but, as it is, the result is likely to be far from satisfactory. So difficult is this situation of the architect and the mason, that I am sure many beside myself have wondered at it and have despaired of getting good results under such circumstances.

Now it occurs very naturally to one knowing all this, that it may be possible to establish training schools where these experiments in brick masonry may be undertaken under more favorable circumstances than as now at the building itself. The architects and the makers and sellers of brick are alike interested in minimizing the chances of failure in what is undertaken, and in increasing the range of what they may successfully undertake. The architect's task so becomes an easier and pleasanter one, and the employment of brick more general.

It seems as though the larger cities could accomplish something in this direction without any very great outlay, either of time or money. Each such city has its Association of Master Builders, to whom one would naturally look for the forwarding of the movement, and the brickmakers, by reason of the large pecuniary interest that they have in the more extended use of brickwork, might be glad to contribute in various ways.

What seems to be essential is, first, the systematic collecting of photographs and drawings of good examples of artistic masonry; and second, a convenient plot of land where these examples may be in whole or in part actually reproduced. This plot of ground might possibly be found in connection with one of the trades schools which are everywhere springing up, or it might be a union yard leased in common by the brick-men for the better display of their goods. Such a spot would become a sort of center to which architects would go to make their selection of materials and actually test new combinations of texture and color before specifying them. The stone-



WITHINGTON MANOR FARM BARN.

men might also be led to join in the scheme, so that all the comparative effects of material might be practically studied in this one yard.

Now, there is nothing in this scheme just outlined that is impossible. If the thing be desirable and worth doing, it can certainly be done. The real question is, what would such a movement benefit those who undertake it, and is it a step in the right direction?

Let us suppose that as a result of such a movement some dozen or two young masons were yearly sent out in each community with a fairly wide knowledge of the best work of their craft that has been done in former times. Let us suppose that they have made themselves acquainted with a large range of examples similar to those which are selected to illustrate this article. They have made drawings of the arrangement of the more celebrated instances, and have built in the school yard just such examples as these, and have seen other young men there who were practising the same effects; so that

PIGEON-HOUSE AT BOOS.

in case they were told to get, with local materials, a somewhat similar effect to that of a particular pattern on the Château d'Ango, they could attempt the problem with confidence and pleasure.

Here, obviously, is a very great gain. The young masons have been brought into their legitimate inheritance as craftsmen. The possibilities of their work are greatly extended and they respect it the more. Its processes have more significance to them, and they are brought nearer to the architect's point of view. They get an architect's idea better for their training, and his drawings and instructions have a significance which they could not have otherwise. Under such circumstances they would work to better advantage, more rapidly, and with more confidence.

The trouble is, now, that if the architect makes a drawing of a certain piece of wall, he must either invent the variations which naturally come in rubble work, or else must make a conventional representation of the design. If he does the latter, — and almost all drawings are of such description, — the workmen tend to imitate the hardness which is inevitable in the design thus presented. The little accidents which make the work in the illustrations so charming and flexible in its look are eliminated by them as far as possible in order to make their work look like the drawing; and this is exactly what the architect does not want.

One of the illustrations shows the gable end of an old barn in England built in the fifteenth century, which I have reproduced here by the courtesy of the publisher of *The Quest*, because, although entirely of stone, it exemplifies so clearly the principle involved. The freedom with which the different-sized courses of stone are combined gives the work an indescribable charm, like a woven fabric. If an architect to-day wished to get this effect, he must either draw it out at very large scale and demand of the masons a Chinese-like copy, or he must trust them to a very considerable extent. As the first method would be impossible, on account of

obvious reasons, and the latter is at present impracticable, it follows that we are debarred from getting masonry of this description.

Now, how did they get it in the old days? Simply by having the man who designed it build it.

Mr. A. S. Dixon, in writing in *The Quest*, of March, 1896, treats very intelligently of this subject. He says: "It is supposed that the medieval craftsmen went about the country in gangs and companies under the lead of their foreman, who must have been very much of an architect, building churches and manor houses and cottages. By working always together they formed a distinct style and tradition of their own, and in different parts of the country one can recognize a similarity of style in most of the buildings of medieval date. It would be much the same as if nowadays builders were always their own architects, or architects their own builders."

This brings us to the whole root of the difficulty, which is that in the building crafts design and execution have become widely separated. The two things naturally take their rise together; and this old work which we have illustrated is of good design solely because it was developed out of the situation in which the workman actually found himself, and was developed by *him*.

The farther back we go in the history of the original styles the

PIGEON-HOUSE, MANOIR D'ANGO.

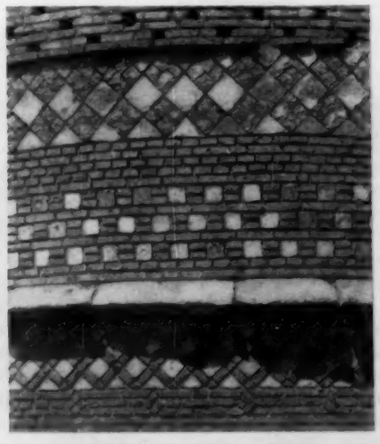
more we lose sight of the architect as a professional man, and the more design rested in the hands of craftsmen.

I cannot refrain from quoting at some length from the introduction written by Mr. J. Alfred Gotch to his two volumes upon the Architecture of the Renaissance in England. The time he is treating of extends from about 1550 to 1650, — from the beginning of the reign of Queen Elizabeth. "It must always be borne in mind," he says, "that those days were widely different from ours. In the present day, if we are struck with the beauty of a building, it is a matter of no great difficulty to ascertain who is the architect, and in all good work we may safely conclude that it is to him we must attribute the happy faculty of giving his materials the forms and combinations which delight us. It is he to whom the rare and crowning glory of design belongs; the workmen are but the ministers of his will. Not so in the period under review; the architect, as we know him, did not exist. The term, indeed, was hardly known. It is only once used by Shakespeare, and then only figuratively. It is important to bear this in mind. To talk of the architect of Kirby,

MANOIR D'ANGO, COURTYARD.

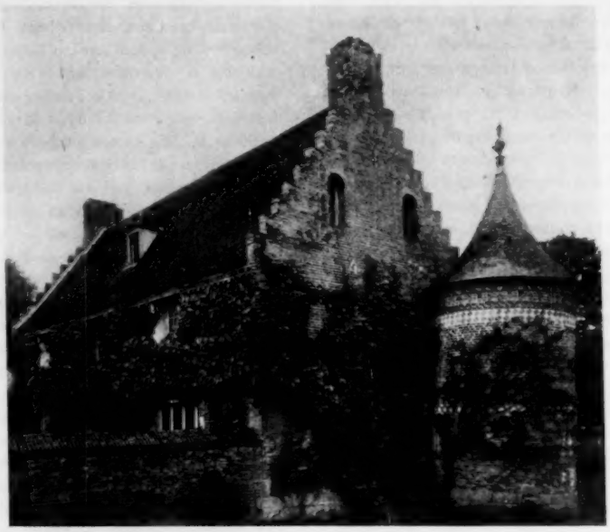
or Hatfield, or Wallaton, is really misleading. There was no such functionary. There was some one who rough-hewed those buildings, but it was left to others to shape them. There was in most instances an individual who supplied a plan, and often also an idea of how the building was to look outside, and therefore this individual's influence was of considerable importance, since it was he who gave form and shape to the structure; but he was not what we think of as an architect. He was called the surveyor, and the surveyor's share being done, his work was elaborated by numerous and insignificant artisans. Having before them the surveyor's general notion of the building — that here was to be a plinth, there a stone cornice, and there a balustrade; that between those windows should be a niche, and between the others a pilaster — it would then seem, so far as we can at present ascertain, that the masons set to work to carry out these ideas in the actual building, themselves supplying the profiles of the cornices and the patterns of the pilasters, and the sections of the mullions. Not infrequently the employer stepped in and said, 'Inscribe me here such and such words,' or, 'Carve me there mine arms, and those of my lady,' which, accordingly, the mason did to the best of his ability, and when he knew nothing of Latin, or was ill acquainted with heraldry, the result was apt to fall short of what was intended.

"But if the mason was instructed only as to the general masses



DETAIL OF PIGEON-HOUSE, MANOIR D'ANGO.

of the building, the carpenter and joiner received even less guidance. There were no sections of the building supplied, showing them the internal treatment. The plan was their only guide. . . . It was the same with the plasterer. He had his stock of designs, which he submitted to his employers without any regard to the surveyor. At Cobham Hall we learn from a letter of the Clerk of Works to Lord Cobham, how 'the plasterer would be sent for to come to bring to yo Lo. modells or paternes of the maner of the sealing that yo L. maie make yo choice of that kind of work that shall best like yo.'"



MANOR HOUSE, ARCHELLES.

This state of things, in which the craftsman had so much liberty, may well mystify us who are accustomed to the routine methods of to-day, but the more one ponders the subject the more natural it seems. Our present condition is an extremely artificial one, and we turn out buildings as rifles, or watches, or locomotives, are turned out of shops. The different parts are allotted to different men, and all work according to patterns which are given them, and which they must follow exactly. This is an excellent money-making principle to follow, but it is destructive to artistic effects; and I believe that we have reached a point where it is apparent that to get artistic work we must, in some degree at least, depart from these artificial methods.

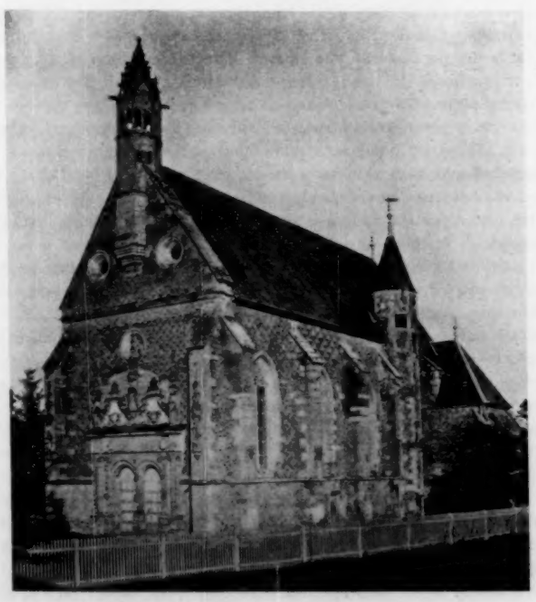
The thing to achieve, of course, is to bring the designer and the workman together, and how can this be done better than by bringing them together during their period of training? The building interests of each city ought to see to it that there is a place where their young apprentices may study photographs and drawings of the best examples of what their respective crafts have done; but this is not enough, for such learning without a chance to acquire it in practise would be of little value. They should have an opportunity to set up in actual materials the examples they have studied; and the younger architects should go — and without any question would go — and learn about these things themselves. It is not pleasant for an architect to be obliged to make his experiments at the expense of his clients, with all the probable chances of public failure.

If, therefore, it were found feasible to start such a yard as I have suggested, and make it a center for experimental study of the treatment of building materials, the architects, I am sure, would do all in their power to support the scheme. They would find the resources of their art increased, and there would be more pleasure in attempting new and varied effects. As the designer and the craftsman come closer together and acquire confidence in each other, they gain in freedom, and the work shows it. Certainly a clever young mason, who has made himself familiar with work such as I have illustrated, and who is competent to execute it from the mere suggestion of the architect, ought to find constant and highly remunerative employment. He would become, in fact, an artist workman, — just what the workmen were four centuries ago in Europe.

All parties interested would be benefited. The man who furnishes the materials is concerned very greatly to have them appear at advantage in the building, for so it is he gets his trade. The owner certainly wishes such a result. The workman himself takes vastly more pleasure in his work and is better paid for it, while the architect is relieved, to some extent at least, from a very embarrassing practical dilemma.

Few people realize the extraordinary pains which a modern architect has to put into such a piece of brickwork as the "Harvard Gates," for example, to secure an effect equal to that of old work. The expenditure in time and energy is so great that few men are willing to give it. Yet it is exactly that sort of pains that makes the difference between effective and commonplace work. A man like McKim can make a brick fashionable and vastly increase its general use, simply because he takes pains that it shall look well.

Is it not, therefore, of very great value to the manufacturers of brick that they should interest themselves in securing conditions which will make their goods habitually appear to the best advantage, — and by this I mean the education of young masons? Have the best manufacturers anything to fear by joining hands in the establishment of a yard where their bricks may be actually set up and seen under normal atmospheric conditions? and would not such a movement result in greatly extending the employment of their product?



CHAPEL AT PAGNY.

OUR buildings should, both outside and inside, have had some of that warmth which color only can give; they should have enabled the educated eye to revel in bright tints of nature's own formation, whilst to the uneducated eye they would have afforded the best of all possible lessons, and, by familiarizing it with the proper combination of color and form, would have enabled it to appreciate it.

STREET.

Architects' Troubles with Brickwork. I.

BY F. E. KIDDER.

UNDER this title the writer proposes to discuss the more common troubles which architects meet with in their endeavor to get a first-class job of brickwork. These troubles, it is believed, are most aggravated in the smaller cities and towns, and especially in localities west of the Mississippi River, although many of them are sure to meet the architect everywhere.

POOR BRICKS. In many localities the difficulty of securing good brick is a very serious trouble. In almost every kiln of brick there are some underburnt or "salmon brick," which the brickmaker must dispose of in some way to get a profit out of his business. He, therefore, tries in every way to work them off, and, as they are sold at a less price than the harder-burnt bricks, the contractor will generally try to use as many of them as he can get the superintendent to pass. It is probably needless to say that these brick are much inferior both in strength and durability to hard-burnt brick, and should not be used in walls exposed to the action of the weather, or wherever they have to sustain any great weight. The great trouble, wherever they are permitted to be used at all, is that the mason is quite sure to use them wherever he can without being discovered by the superintendent.

In many localities coal slack is mixed with the clay of which the bricks are formed, so that even the bricks that are well burned are very poor, indeed. The quality of common brick varies greatly in different localities. In many localities, and particularly in some of the Western States, the best common brick are not much, if any, better than the salmon brick made around Boston. Another difficulty in getting the desired quality of brick, that the writer has met with, is in the local classification of bricks. Thus in some localities there are salmon brick, red brick, hard brick, and arch brick; the red bricks being commonly classed as a "well-burned brick," although they are often not much better than a good salmon brick. The writer has had bricks delivered at his buildings that could be broken in two in the hands, or could be crushed by the heel, being really nothing but a mud brick. These bricks were mixed in with hard bricks, and much watching was required to prevent their being built into the wall.

LAYING THE BRICKS DRY. It is the opinion of the writer that the importance of wetting bricks before laying is not as generally understood as it should be. In warm, dry weather no bricks should be laid in a wall until they have been well wet, and the more porous the brick the greater the importance of their being wet. Brick-masons, however, do not like to wet the brick, not that it costs anything to speak of to wet them, but the water that the bricks absorb makes them much heavier, so that the hod-carriers cannot carry as many bricks, and the wet bricks are also hard on the hands of the bricklayers. If, therefore, the brick-masons can find some way of getting out of wetting the bricks they are quite sure to do so. The writer has known several instances where they have gone to the owner and tried to convince him that the wall was better for not wetting the bricks.

In building a brick church in the country, to which only occasional visits were made, the writer found on the first visit that the masons had been laying the bricks dry, although the specifications required that they be wet with a hose, and the building committee had been especially cautioned to see that it was done. Upon inquiry it was found that all the old brick-masons in the town had told the committee that they always laid common bricks dry, and that these particular bricks would not stand wetting, and the committee, like too many others, concluded that the architect was not posted on practical brickwork. The only way to convince them of the importance of wetting the bricks was to go around and lift several bricks from the wall. In every case the bricks came up with the bottom bed *as clean as before they were laid*, the bricks being so dry that they had absorbed the moisture from the mortar, and thus prevented adhesion. The contractor was finally made to admit that the wall was stronger for having the bricks wet, and the eyes of the committee were opened.

MORTAR. Very often the architect is troubled with the quality of the mortar used. Masons, in all localities, are very apt to put in too much sand, and in localities where several qualities of lime are sold, they are quite sure to buy the cheapest quality, assuring the architect or superintendent that "any lime is good enough for brick mortar." This is not so, and no lime should be used in brick walls that will "pop," especially if the plastering is to be applied directly to the wall. To secure the best work it is important that good lime, in the proper proportion, be used, and that it be slaked a week or ten days before using. When the writer first came to Colorado, it was quite a common practise with brick-masons to mix a fine, sandy loam with their mortar, saying that it "made the mortar work better." In one sense they were right, as the loam, being fine, helped out the lime, and the mortar left the trowel cleaner than would have been the case had the *same proportions* of lime and sand been used without the loam. The real object in using the loam was that they might *save on the lime*, the difference in the cost of the two naturally being very great. It should be hardly necessary to say that the use of loam in mortar greatly deteriorates it, and it should never be permitted. Whether or not this custom has been practised in other localities, the writer does not know.

SKIMPING THE MORTAR. This is another very frequent source of trouble to architects, especially where there is sharp competition, and the work is let to the lowest bidder. The strength of a brick wall certainly depends as much upon the quality, amount, and adhesion of the mortar and the bond of the wall as upon the quality of the bricks, but many masons seem to care very little about the strength of their work, provided it looks all right on the face, and will be accepted when finished. It is not uncommon in the West to see the middle course of bricks in a 12-in. wall laid dry, and a little mortar spread over them, to make it look all right. If such a wall were taken down it would be found that the joints at the sides and ends of the bricks contain very little mortar, and, of course, in such a case there is very little adhesion in the brickwork and consequently very little transverse strength or resistance to buckling.

BONDING. In bonding the walls the masons seem to have a prejudice against having the bond courses too near together, although it does not require any more bricks. Where ordinary bond is used, however, the frequency of the bond courses shows on the surface of the wall, so that there is not much chance to deceive the superintendent in this particular. The greatest defect in bonding, as observed by the writer, is in the bonding of the face brick to the backing. Generally diagonal headers are used, and very frequently these are seven or eight courses apart, and only one header to every other brick. Diagonal bond is a poor bond at best, and when used a header should be used to *every* outside stretcher, in the bond courses, and the heading courses should not be more than six courses apart. The better practise is to use the Morse wall tie, if plumb bond is desired.

FACE BRICKWORK. The difficulty of securing good face brickwork is often a very vexatious trouble to the architect, as a poor job cannot be concealed and is always an eyesore. As a rule, this difficulty is not so much in having the bricks laid well as in getting a uniform shade of brick. When a mottled effect is desired there is not quite so much trouble, but even then if several bricks of the same shade are laid together, and then more bricks of another shade, the wall will have a very "patchy" effect. In a large front it is often a very difficult matter to get a piece of brickwork that will be uniform or harmonious throughout, and not show alternate streaks of light and dark shades. Even when the bricks are of the same shade, a difference in the wetting of the bricks will often cause a difference in their appearance when laid, which does not always disappear as the wall dries out. In the opinion of the writer pressed brick should never be wet down with a hose, but should be dipped in a bucket of clean water on the scaffold. They should also be

kept covered in the pile, as a heavy rain will often discolor them. In the laying the greatest difficulties, probably, are to keep the walls plumb and the courses horizontal, with the end joints plumb above each other. Where bricks are laid from the inside, as is the usual custom in the West, the courses at the scaffold level are very apt to get pushed out, and should be carefully watched. A very slight displacement of a brick will show up very prominently when the sun shines on it. Another point that must be watched is the thickness of the joints, that is if close joints are desired. It is much cheaper to have a wide joint than a close one in any kind of brickwork, and the masons, therefore, prefer to lay as wide a joint as the architect will permit.

CRACKS IN BRICK WALLS often cause a great deal of trouble, and are sometimes hard to prevent. They are generally due more to improper planning of the foundations, and to lack of sufficient ties, or other precautions on the part of the architect, than to poor work on the part of the contractor, although they are more likely to appear in a poorly built wall, especially if soft brick are used, than in one that is well built with hard bricks and first-class mortar.

EFFLORESCENCE ON BRICKWORK, fading of mortar colors, and the stopping of chimney flues also tend to make the lot of the supervising architect an unhappy one. *How to overcome these troubles.* Many of the troubles herein mentioned can be largely, if not entirely overcome by the knowledge and foresight of the architect, and in the next number the writer will endeavor to show how, in his experience, they may be best avoided or reduced to a minimum.

THE principle which artists now have mainly to contend for is that of TRUTH. Forgotten, trodden under foot, despised, if not hated for ages, this must be their watchword. If they be architects, let them remember how vitally necessary truthfulness in construction, in design, and in decoration is to any permanent success in even the smallest of their works. STREET.

FIRE-PROOFING FLOOR OPENINGS.

IN estimating risk in a fire-proof building used for purposes other than offices, such as stores and warehouses, one of the most important items to be considered is the manner in which the floor openings are to be protected from each floor stock in case of fire. In these openings may be included freight or passenger elevator shafts and stairway or hallway shafts.

In buildings used for storage or manufacturing, where little attention is paid to finish of doors, trim, etc., the usual standard metal-clad door and heavy wire glass windows may be used with iron jambs and lintels.

In a building in which many people are constantly moving in and out, and where taste and design are generally considered more important than protection from fire, the difficulty arises of providing proper protection.

If the hallway shaft, which may contain stairs and elevators unenclosed in fire-proof shafts, is separated from each floor stock or main area by fire-proof partitions with standard doors, lintels, jambs, and windows, a considerable reduction may be made in charging for internal exposure. The question then arises whether this reduction in insurance would pay for the outlay necessary in putting in these doors and this trim. In most cases it would pay; because when once done the reduction is permanent. But there again arises the question, how can this be done without spoiling the general refinement of design? There seems to be a field of success for some one who will invent an absolutely fire-proof material for trim and doors, including jamb, lintels, etc., which may be suitable in appearance and easily worked.

In the new building on the corner of Union Square and 17th Street, a new scheme has been evolved which has apparently met with the necessary approval of the insurance companies without losing anything particularly in its treatment of finish or taste in its designs.

(*Continued on page 170.*)

Notes on the Design of Brick Buildings.

BY GEO. F. NEWTON.

IT is of the greatest importance to the student of architecture to train his imagination that he may see his buildings in their various forms and possibilities as the plan is developed. The architect must see his creation definitely in his mind's eye in the location for which it is designed, and also see its organism plainly if he does not wish to be disappointed in the end. This ability to see a conception and work it out in one's mind is most valuable, in fact, indispensable to a successful issue. It was the habit of a famous architect, and is probably of many successful architects, to work out his problem in his head carefully before touching pencil to paper, and his thumbnail sketches, or the results of this mental modeling for the guidance of his assistants, are marvels of accuracy. This ability is only acquired by constant exercise of the imagination and wonderfully assists the creative faculties.

It is not only necessary to see the building, but its effect when modified by surrounding objects; and there are many remarkable proofs of the complete dependence of architecture on its situation and of the utter impossibility of judging of the beauty of any building in the abstract. The nature of the situation will demand usually some recognition of it in the building. There are as many forms of edifices as there are peculiarities of situation, and if we abandon the idea of correspondence with the situation we lose oftentimes the most valuable accessory for a successful general effect. In certain cases it is the most important consideration to secure a happy general effect with the surrounding objects. The general aspect of the country, if severe and bold, or domestic with cultivated fields, will be considered by the trained architect and will influence his design. This is akin to the field of landscape architecture, and the education of the architect is sadly neglected who has not given this side of his art serious study. In the magnificent modern villas in the Berkshire Hills we see, within a radius of ten miles, an Italian villa, an adaptation of the feudal castle and the English house; and a Francis I. château will doubtless appear in time. It surely has the charm of novelty; but to the sensitive it must seem somewhat incongruous for the resident of a stately, narrow-windowed Elizabethan house to be transported to the adjoining estate, to enjoy hospitality at a brilliant Italian villa with characteristic furnishings. Of course the owner has the privilege in the country on his extensive estate to indulge his preferences and surround himself with any period of art which most interests him; but this does not affect the truth that certain types of buildings harmonize best with certain characteristics of country. We labor under a certain disadvantage in not possessing a national style. If the Italian villa were a national type for rural buildings, it would take its place quite naturally in Berkshire country. Under the same circumstances the Tudor house, perhaps, would there seem as appropriate as among the hills of Somersetshire. There are situations where the horizontal lines of the Italian house harmonize as no other type can with the curves of the hills and contrast beautifully with the upright lines of pine and poplar, when the vertical lines and gables of a Tudor house would be discordant. The design of the dwelling is sometimes controlled by a great elm, or other peculiarity of the situation. A group of delicate locust trees would demand a different treatment of the house from that which could associate with a group of sturdy oaks. So it must be in the infinite variety of circumstance of situation, to say nothing of the peculiarities or eccentricities of the owner or of the building itself, which must be considered and to an extent expressed in the dwelling.

In the same manner the building in the city must be analyzed. A certain conception, however beautiful of itself, may be ill-suited to one location and its beauty greatly impaired by environment. Good taste and feeling for the fitness of things are essential to the successful practise of architecture, as without them the most chaste and otherwise carefully thought-out building will not give the pleasure it

was designed to inspire. The nice judgment necessary to the architect in selecting from many possibilities the most appropriate design in scheme, proportion, and color, which conception will be the noblest, the most beautiful and best adapted to its purpose, require what a few seem to be to some extent happily endowed with, an innate sense of the appropriateness of things, while with the greater number this must be cultivated by untiring research and observation.

Of the mode of uniting a building with the near features of foliage and ground or the complications in this regard in city architecture, it would be utterly useless to speak; it is a question of infinite variety, involving the whole theory of composition, so that it would take volumes to develop principle sufficient to guide us in a result which the feeling of the practised eye would arrive at in a moment.

A wide range of knowledge must also be acquired to design buildings which will harmonize with the great variety of conditions in their environment. Problems with their many considerations must be logically thought out instead of applying some favorite motive, or leaving to the tender mercies of the draughting room to fulfil all the conditions. The head must do the work first, a good idea must be culled from a well-stocked mind if an appropriate architectural building is to be the result. It requires much skill to so arrange the parts of a building that it will be architectural, and still serve its uses well. The scheme sometimes comes to the architect in the crudest possible shape, probably worked out as the client may suppose in its most convenient arrangement, and he expects the architect to put an architectural dress upon it and retain his plan. The client's version of the problem may not be the best, and the architect cannot work intelligently until he has become acquainted with the actual requirements. The shortcomings of our architecture can seldom be laid at the door of the owner. He would not employ an architect if he did not expect architecture, and he will usually accept an equally good or better solution if thereby its exterior be benefited.

MUNICIPAL PALACE, GUBBIO, ITALY.

He is even willing in many cases to put up with a moderate amount of inconvenience when necessary, if his building will be more beautiful. The rearrangement of portions of his scheme is not for the object of disguising the character of the building, but to give it more agreeable proportions. The uppermost thought should be to express the uses to which the building is to be put, as character is of the first consequence. There are many kinds of buildings which the architect is called upon to do, and to preserve the character of each is more important than to give them a particular historic style of architecture.

It is frequently thought necessary to add a tower or other decidedly marked feature to a building such as an armory, storage building, or factory, solely because the designer thinks it becomes more imposing or the composition requires something to ennoble and dignify it. There is sometimes a misconception in this respect; it does not seem right to add extraneous features to a building to make it seem imposing, or invent uses for features not naturally required in the scheme.

Certain buildings of their very natures cannot, nor should they, awaken elevated ideas, nor assume nobility of form; they can have none of the grace of beauty nor of dignity which another class of edifices may assume, but must be structures of every-day life, a protection from inconvenience and exactly typical of their uses, regularly planned, mechanical, well-thought-out buildings.

We have seen many buildings in Europe with masses so happily arranged as to agreeably express the nature of the building, where dignity or picturesqueness is secured by emphasizing, perhaps, its peculiarities without the invention of these larger motives which really belong to buildings of another character. We see about us such a medley of appropriated motives that the public is daily being deceived in its judgment of what is good taste in composition. We find towers used in the acknowledged best periods of art where they have a useful purpose. They were not applied indiscriminately to make the composition interesting. They were constructed as places of observation, then for city halls, partly for the same purpose, and also very properly to indicate the municipal wealth of a prosperous community. The campanile had its use, and this was merged into church buildings in various forms, all for a purpose. And now we see a fitness by historic use of the city hall tower and the church tower.

In modern times the tower has lost much of its suggestiveness, and consequently its character and dignity. It is applied to almost any building, by the thoughtless architect or the client who demands that his project shall overtop his neighbor's and proclaim his vanity. The trained architect may design a high or tower-like portion of a building, and model it in such form that it will not compete with a city hall or church. Why should a school or academy building have a tower? We cannot recall any of the college buildings of England which boast of towers save their chapels. Engine houses are a modern invention; the problem demands a place for drying hose of lengths of perhaps 100 ft., which means in a building of two stories a tower-like structure of perhaps 100 ft. in height. Some of these structures, which should be simple, vie with the town halls of Italian cities, their towers modeled after the belfry of the Municipal Palace in Florence, with a lookout as in the days long since past, when the watchman kept his vigil over the city day and night. If a tower is needed for the purpose of drying hose, and solely for that, it should be so designed to fill this use with a pleasing outline and simple adornment, and placed where it will compare well with the building. It is perhaps as much from the desire to use the opportunity for all it is worth as from want of appreciation of the fitness of things that this abuse is caused. This is a species of error which it is very difficult for persons paying superficial attention to architecture to avoid. The trained architect seldom makes this error, as he has acquired the sense of appropriateness by his study of historic architecture. Sometimes a project calls for a high object, a water tank, or ventilation shaft, or a chimney. It is not good architecture to treat it as a campanile with clock and observatory. These objects may demand a high structure on or near the building, and they can be treated in a quiet or picturesque way as conditions demand, and not made conspicuous objects when their uses are merely utilitarian, perhaps for the sole excuse of an opportunity to display skill or the use of a favorite model. There are certain buildings where a tower seems appropriate, as in one devoted to public uses. The great

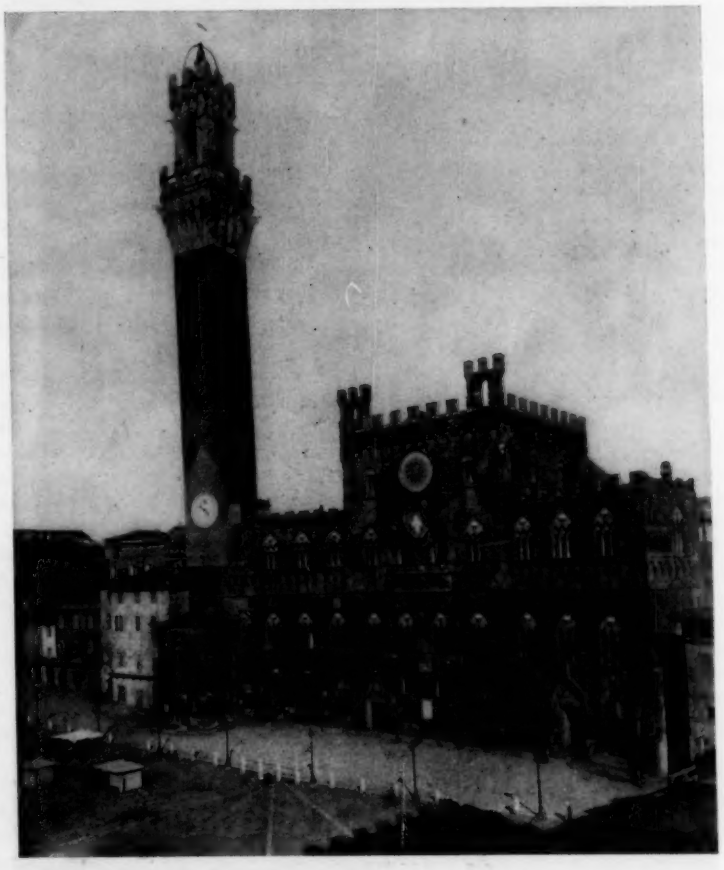
Cloth Hall at Ypres is worthy of its majestic tower and implies a wealth and importance of a widespread national industry; the building of the character of the Trocadero at Paris seems right with its tower; or an important group of buildings or a railroad terminus may be marked by a tower. There are comparatively few instances where the tower should be used. Our architecture is restless; towers, gables, bays, tourelles, etc., produce nervous, agitated lines, cutting up the structure into small parts, destroying all breadth and nobility; and these buildings must remain for years with their tiring influence on the eye of the distracted wayfarer.

The architect should consider well what effect on the beholder he wishes his buildings to produce, what story he wishes them to tell. They should speak as plainly as the sculptor's group or the painter's canvas. Its purposes decide for the designer. To a sound building he may add nobility, magnificence, or chasteness. "The value and rank of every art is in proportion to the mental labor employed in it, or the mental phase produced by it." As this principle is observed or neglected our profession is advanced or retarded.

The dome, like the tower, by its appropriate use may crown the stately capitol or cathedral church, and form the central object of a great city. A less ambitious form of the dome may, with skill, be appropriately employed in a great variety of buildings, its form and decoration being modeled as the exigencies of the case require and always controlled by the trained architect. It is so with the various features or forms handed down to us by past ages, the pediment, cupola, etc. The appropriate use in the composition, the knowledge as to whether the building will warrant the employment of these larger, nobler forms, must be obtained by a study of precedent and by years of training — true feeling for the fitness of things. There is no form in architecture possessing greater dignity than the pediment with its stately portico, but this feature is appropriate to but few buildings. We sometimes see in a city street a pediment attached to a merchant's house worthy of a president's mansion. Grand forms lose their value when misapplied. A dignified frontispiece requires something back of it more than a citizen's dwelling. We see over our land the echoes of the World's Fair buildings in the citizen's house or civil building, all of which indicate remarkably good taste in the selection of a type for admiration, but a lack of appropriateness in its application. What will the architect do for forms in college or municipal buildings if the individual appropriates these monumental forms in miniature for dwellings? We see all three — tower, dome, and pediment — employed in a cathedral, but they would be ignoble in a small edifice.

It will bear repeating that the material should in a great measure control the design of a building in hand. How can a design for granite be executed in bricks or marble on the same lines, and *vice versa?* Yet this is done frequently. The design is made with no reference to material. This is left for later consideration. The same drawings stand for a building of granite, white marble, or terra-cotta and brick. This saves time, no doubt, but is it architecture? How rarely do we see a building entirely successful? It is lacking in some quality, indicating that the architect overlooked certain considerations. Time is necessary even for a thoroughly equipped architect to do good architecture, and too few are willing to give it.

There are many brick buildings which have been treated in a manner characteristic of the material, making essentially a brick design, with perhaps a very limited use of terra-cotta or stone in portions where our climate requires a protection to the small material with many mortar joints. As remarked above, the uses of the building determine its masses or ultimate character. This in turn suggests, sometimes compels, the principle of decoration which should be employed on its surfaces. If the building is much higher than it is wide, campanile like, its principal decorative lines should be in sympathy with the form, which in this case is upward or vertical. No amount of horizontal bands will make it seem less high. Why should it not seem high? The architect should glory in this quality and take every advantage to emphasize this characteristic. The theory that the bands mark the floors does not at all assist the æsthetic effect. It is not of the first consequence to express what happens inside, but it is of the first importance to present a pleasing architectural exterior, and a too close expression of the interior is incompatible with good design. The reader will readily recall examples of these principles in historic and modern buildings where he may compare results in this general treatment of decoration. One does not expect repose to be the dominant element of a high object. Rather should he be inspired by its majesty, its soaring height, as if the thing rejoiced in its exhilarating upward flight. It should stand triumphant, with a firm hold on the earth and a proud crest, the intervening space simple, rigid, and strong.

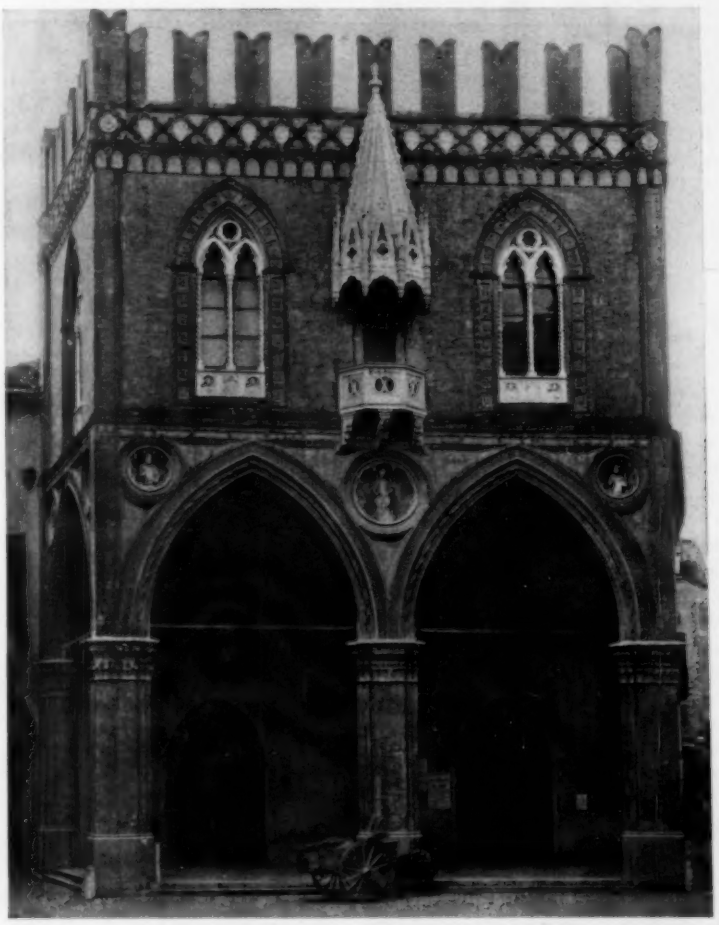


MUNICIPAL PALACE, SIENA, ITALY.

The eye runs naturally to the summit of a high object, be it mountain or the structure of man, and there hopes to be satisfied, whether by sparkling snow-cap or exquisitely modeled cornice. What happens between base and summit does not make a lasting impression. On the other hand, one does not expect exhilaration of the senses from a long, low building, but a quality equally desirable and as necessary to human enjoyment. Here the decorative lines should be horizontal, and the less they are interrupted the more reposeful the building appears. It is folly to attempt by breaks and towers to add

height to it. Better would it be if the neighboring church spire, a great tree or other high natural object would, by contrast, tell how low and quiet the long building really is, and the truly great architect will grasp this peculiarity of the location and construct a building which will by contrast or harmony add to the beauty of the scene, whether in the public square or in rural architecture.

Much of our enjoyment of architecture, as well as of natural scenery, is lost by failure to compare with objects with which we are familiar. The painter enjoys a beautiful view or a quality of light or tone because he has trained himself to appreciate the phases of nature. He goes forth each day enjoying the beauties unsuspected by others. It is so in relation to many works of architecture, perhaps unfortunately placed, as an architect can rarely control the surrounding objects, and by comparison his achievement will seem mean. The brutal, towering monster, built for utilitarian purposes, may swamp his carefully studied building which respects itself and may command the admiration of the few, but if there is a standard in the mind of the beholder, objects may be appreciated and noble architecture enjoyed, notwithstanding environment. How vast the mountain seems with the cottage nestling on its side, how glorious Amiens when compared with a figure entering its great portal!



EXCHANGE, BOLOGNA, ITALY.

For architecture the human figure must be the unit of appreciating the size or scale. It is specially imperative that the architect and the student shall have constantly in his mind this unit for measuring scale. There is none other reliable. Conditions and surroundings vary to such an extent that no other will answer. If in his travels or in his daily observation he forms the habit of mentally comparing the human form to the size of architectural objects, he will find that he has acquired a great assistance in judging of the scale of parts of his designs. Photographs which show the true comparisons of objects will be of greater value to him as a source of study. If he draws the figure on his scale drawings he will not build his church for the sanctuary of giants, nor an arcade which will permit the sculptured capitals to be profaned by the fingers of passers-by.

Architecture should not, by its scale of parts, belittle man, as is said of St. Peter's, but inspire and beautify his life. In the colossal halls of Egypt, such masses of architecture arose as we feel crushing down upon us with eternal weight, but by the delicate sculptured and colored reliefs on the walls and columns are brought into sympathy with the observer. In much of the Roman work the monumental masses are brought into a pleasing relation to the man by the fortunate scale of the decorative parts.

A structure of bricks may possess grandness of parts with this dwarfing and overpowering effect as much as stone.

The brick fortress of Saragossa and the ramparts of Perpignan are as impressive as Carcassonne or Angers.

If these brick units are emphasized in places near the eye by well-chosen detail, such as ornamental brick, this contrast between the mass and the detail would evidently be more apparent and add greatly to the scale of the edifice.

The study of scale and composition are closely allied, and the best way to study scale, whether in the relative masses of a composition or the disposition or size of windows, bands, or other ornaments, is by the thoughtful observation and comparison of buildings both old and new. One sees really comparatively few buildings entirely successful in this respect. A student should cultivate this faculty of comparison and improve every opportunity to test his knowledge and acquire better standards. The principal benefit of the measurement of foreign work is in obtaining a refined judgment of the scale of the work. The student should go out of his way to watch the erection of a building by an architect of known ability, in order to see the various details before they are placed in the building, where they will be inaccessible to him. He must also study them when in place in the walls. A study of this kind will be of immense assistance to him in obtaining a happy adjustment of parts in his buildings both of mass and decoration.

Between the very high and narrow building and the very low and long one there are innumerable variations in the treatment of masses and related parts. These may be considered in a study of special buildings. The title "Brick Buildings" will awaken, without doubt, a different idea in the mind of every one who reads these words. None will have any definite idea of a fixed character stamped on brick buildings. There are many styles of architecture which permit the building to be either of stone or of brick. The general design gives no clue as to what the material is. The outline or disposition of masses in these does not suggest any special material. There are also periods of art which one at once associates with a brick style of architecture, as in the buildings of Hanseatic and North German towns, or Italian medieval and Saracenic architecture.

The illustrations which are shown in connection with this article are borrowed from the collection of the Philadelphia and Boston Face Brick Company, who have given much time and money to securing the best examples of foreign brickwork wherein pattern brick have been used.

Fire-proofing Department.

Conducted in the Interest of Building Construction to Prevent Loss by Fire.

WHAT CONSTITUTES A FIRE-PROOF BUILDING MATERIAL?

BY PETER B. WIGHT.

ANY answer to this must necessarily imply that it is something which is not only incombustible, but not subject to become useless for the purpose for which it is intended, under the conditions to which it may be subjected. There are a considerable number of materials that fulfil the first condition, but few which comply with the last. In fact, many of the former are necessary in construction, and when so used must be protected by the latter. We have, therefore, less to do, in this consideration, with materials of construction than with those subject to destruction. Of the former brick and iron are the principal ones in use, and a later addition is found in hollow brick or hollow tile made of clay. All have great strength, and each is appropriate for a certain use. But iron and steel, which are the strongest building materials in use, are admitted to be only useful when strength alone is required. Brick is, and for a long time may continue to be, a standard building material, where strength of wall is required, having fire-resisting properties. But this is not the case with all bricks, for there is a great variety in the clays from which they are made and the manner in which they are burned. They vary from the underburned red brick, containing a certain proportion of iron oxides, to the No. 1 fire-brick, which contains very little iron. The former can only be manufactured by a low degree of heat, and the latter only by a high degree. It follows, therefore, that the low grade brick has bad fire-resisting properties, while the highly burned article has good fire-resisting properties. This has been repeatedly demonstrated in burned buildings, for it is not uncommon to find bricks melted off to half their thickness, chipped off to the depth of a full course, or entire brick walls cracked on account of too rapid absorption of heat. The unreliability of even the best of common brick was felt to be so great, when the first section of the Monadnock Building at Chicago was erected, that the owners lined the exterior walls with No. 2 fire bricks.

Hollow bricks and larger hollow tiles are also used for independent constructions, but not to so great extent or for such high and heavy walls as common bricks. As such they are subject to the same conditions of manufacture as bricks. But besides these a considerable number of other materials have been put on the market, manufactured in similar shapes and claiming to be fire-proof. These are all made of a plastic material, but not completed in their manufacture by burning. Then, for the lighter interior constructions, we have the same plastic materials used so as to come to a permanent "set" in position; and there is every grade of them from common lime and sand mortar and calcined plaster, to the highest grades of Portland cement. These ingredients are sometimes used for a completed article, and sometimes in combination with a stiffening and strengthening material, such as iron and steel in the form of bars, T's, L's, in sheets, or in the form of wire.

Experience has shown that they are all more or less useful according to the place in which they may be employed; but there is a large margin to the judgment that the architect may exercise in the use of these methods. Every right-minded man naturally desires to use the best, but it is not every one that succeeds in doing so. Of the plastic materials, none except the best hydraulic cements used in large masses have ever been proved by experience to be fire-proof. All thin coatings and combinations with wire and sheet metals have been proved to be inexpensive substitutes for more reliable methods. As far as the actual resistance to intense heat is concerned, common lime and sand mortar in small quantities, that is, when used for the joints between bricks, or as plastering in a brick wall, has greater fire-resisting properties than any other plastic material. It is not uncommon for the surfaces of bricks to be melted and the mortar joints to be left standing out from the wall like a honeycomb. The writer picked up in the ruins of buildings after the Chicago fire of 1871, complete honeycombs of mortar from which all of the bricks had disappeared except where they were melted and adhered like a thin glaze to the mortar. It also frequently happens that the plastering, when of lime and sand only, protects a brick wall when applied directly to it, when, under the same heat, an unplastered wall has been melted away on the surface. If lime and sand mortar had sufficient strength to be used in bodies four or more inches in thickness, it would be superior in fire-resisting properties to Portland cement. But as the latter only can be relied upon for constructive work in masses, it will continue to be the only plastic fire-proof material for carrying great weight.

The purpose for which a fire-proof building material is intended has been set forth above only in part, when referring to brick walls. For such it must have sufficient strength to resist compression, and a consistency to resist the most intense heat of a burning building. Let us see what this is. While in some conflagrations wrought iron has been melted, common experience has shown that few buildings burn with greater intensity than the melting point of cast iron. This is from 2,000 to 2,700 degs., according to quality. At 2,200 degs., iron assumes a bright orange color, and at 2,372 degs., it is at a white heat. The welding heat of wrought iron is 2,733 degs. The temperature of the roof of an ordinary reverberatory furnace which must be resisted by the best fire-brick is said to be 3,992 degs. All these are degrees Fahrenheit. It follows that any thoroughly fire-proof material used for interior constructions, to be of service in severe tests, must be such as will stand a heat of 2,500 degs. without losing its integrity, and fire-brick will easily do this. Of all known materials of such reasonable cost as to make it practicable to use them, clay is the only one that will stand this ordeal. It is the only material which can be so used that is itself the product of fire; and the degree of heat used in its manufacture determines the extent of its usefulness for this purpose. The deposits of nature give us all the varieties from the common loamy earth only valuable for making earthenware flower pots to the highest grade of refractory clay used in combination with other materials for making the best quality of fire-bricks. Each kind has its own vitrifying point, beyond which it cannot be burned without destruction, and any kind that will vitrify below 2,500 is not only likely to be insufficient in strength, but useless for fire-proofing purpose. If subjected to the test of such a heat, it will be found that many of the clays now used for the manufacture of fire-proof material are valueless for that purpose.

But, in every burning building, it is not only essential that the material shall resist heat, but, as stated in the first sentence, it must be useful for the purpose for which it is intended *under the conditions to which it may be subjected.* The most important, and often fatal, of these conditions is that it must preserve its integrity when being suddenly cooled. The cooling in this case is always caused by throwing cold water upon it. Water acts in two ways, and they are often counter to one another. One is by causing sudden contraction, and thereby cracking it, and the other is by the sudden expansion caused by its absorption and conversion into steam, thereby resulting in disintegration. The absorption by plastic substances, such as mortars and cements, also causes a chemical change, which is more destructive than either. In the case of clay materials the hard bodies are in danger of cracking and the soft bodies of expanding. There is, hence, a perpetual argument between the advocates of hard and porous clay products. Tests and experience in actual fires have shown that the value of the hard products depends upon their cellular structure, in which the protection is afforded by non-conducting air spaces; and it stands to reason that the greater number of these spaces the better service they will give. Thus far,

when made of good refractory clay, nothing more than the outer surface has been destroyed in ceilings and partitions, when two or more air spaces were provided, admitting of repairs without taking out the blocks. The porous terra-cotta, miscalled often for commercial purposes terra-cotta lumber, depends equally for its value upon the quality of clay used. If the body is not firm and crisp and burned at a high temperature, which reduces every particle of the sawdust to ash, it is easily disintegrated by the steam formed in it when water is thrown on the heated surface. The best manufacture has resisted the destructive elements of fire and water better than the best hard tile, but the poorer qualities are inferior to either. It is an evidence of unsoundness if the surface of such blocks is easily abraided or makes dust, and it should always have a slight ring when properly fired. Among its advantages are the fact that the material itself is non-conducting, without regard to its cellular structure, and it can be made and used in the solid as well as the hollow forms. It is far superior for column and girder protection to any other clay product, and has for an advantage that it can be cut with saws. Its ability to hold nails is one which has not been proved by general experience.

In conclusion, it must be assumed that a true fire-proofing system can only be based upon the use of one and only one material, namely, hollow clay blocks for all interior and roof constructions, and the protection of iron and steel. Such may be either of dense or porous clay, and the best of them will be of fire-clay. Clay is the most plentiful building material on the face of the earth, and so cheap that it is not necessary to look for anything cheaper. One great advantage it has over solid concretes made of hydraulic cements so much used in Europe is that it can be made so much lighter. The clay must be of the refractory kind, that is, it must be either a plastic fire-clay, a semi fire-clay, or a fire-clay mixed with a plastic clay or shale. The best fire-clays in their natural state are too "short" for this purpose and too brittle if highly burned. In the manufacture of porous terra-cotta very few clays have been found that are both practicable for making a good article and reliable to resist fire when in use. The places where the best have been found are Brazil, Indiana, Chaska, Minnesota, and several districts in Eastern New Jersey. For the manufacturer of hard fire-clay material good clay can be found in many localities. The best are the eastern clay belt of Ohio and the Panhandle of West Virginia; Utica and Ottawa, Ill., St. Louis, Mo., and near Lincoln, Cal. They are all white or buff clays, the buff clays being preferable on account of their toughness. No clay that burns red or salmon color is fit for a fire-proof building material. The greatest error of American architects has been in the acceptance of so called fire-proof materials made of inferior clays.

FIRE-PROOFING FLOOR OPENINGS.

(*Continued from page 165.*)

Over each door and transom window is placed a wooden box of some design and molding. In this box is a rolling steel shutter which travels in a groove in the jamb of the door. This box is so arranged that it forms part of the general design of the door or window frame, and apparently conceals the use for which it is intended. Back of this box, extending down both sides of the door or window, between the trim and the frame studding, is placed sheet iron in strips well fastened to the studding. At night these shutters are pulled down over doors and windows, effectively closing each floor from communication with the hallway, thus shutting off the other floors in case of fire in that one.

The scheme of shutters over internal openings is not particularly new, but the fact of concealing them so that their unsightliness may not be a part of the general finish is at least unusual. Of course this has not the general advantage of an absolutely fire-proof door, window, and shaft. Yet if a guarantee is given that such openings are closed at night, it is quite natural to suppose that this would be an effective cut-off for any fire, as long as was necessary to gain control over it.

OLIVER H. P. LAFARGE.

Mortars and Concrete Department.

Devoted to Advanced Methods of using Cements and Limes in Building Construction.

AMERICAN CEMENT.

BY URIAH CUMMINGS.

CHAPTER VII.

CEMENT TESTING. (*Continued.*)

THE specifications covering the use of cement on the new Croton aqueduct for New York City, and drawn by the chief engineer, Benj. S. Church, 1884, were as follows: —

"The greater part of the masonry is to be laid in American cement mortar, but Portland cement is to be used whenever directed.

"The American cement must be equal in quality to the best Rosendale cement; it must be made by manufacturers of established reputation; must be fresh and very fine ground, and in well-made casks.

"The Portland cement must be of a brand equal in quality to the best English Portland cement.

"To insure its good quality, all the cement furnished by the contractor will be subject to inspection and rigorous tests; and if found of improper quality will be branded, and must be immediately removed from the work; the character of the tests to be determined by the engineer.

"The contractor shall at all times keep in store, at some convenient point in the vicinity of the work, a sufficient quantity of cement to allow ample time for the tests to be made without delay to the work of construction.

"The engineer shall be notified at once of each delivery of cement. It shall be stored in a tight building, and each cask must be raised several inches above the ground by blocking or otherwise."

The tests employed on the line of the aqueduct were those recommended by the American Society of Civil Engineers, which are herewith given.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

REPORT OF THE COMMITTEE ON A UNIFORM SYSTEM FOR TESTS OF CEMENT.

PRESENTED AT THE ANNUAL MEETING, JAN. 21, 1885.

To the American Society of Civil Engineers: —

Your Committee, appointed to devise a uniform system for tests of hydraulic cement, has the honor to submit this final report. Those portions of the preliminary report presented at the Annual Meeting held Jan. 16, 1884, which are not embodied herein, are superseded.

A uniform system of testing cement, in order to be practical, must be simple, rapid, and easy of application, and should, of course, be reasonably accurate. Between the very careful tests of the laboratory, which consume much time and involve considerable expense, and the rough and unsatisfactory trials often resorted to from necessity, there is a middle ground, which it has been the endeavor of the committee to occupy. The system proposed is by no means a perfect one — such has not yet been discovered — but it is hoped that it will be useful in eliminating many of the inaccuracies of the usual methods, and by making the system uniform, enable the experiments of the various members of the profession, in different parts of the country, and others interested in the subject of cement testing, to be satisfactorily compared.

The testing of cement is not so simple a process as it is sometimes

thought to be. No small degree of experience is necessary before one can manipulate the materials so as to obtain even approximately accurate results.

The first test of inexperienced, though intelligent and careful persons, are usually very contradictory and inaccurate, and no amount of experience can eliminate the variations introduced by the personal equations of the most conscientious observers. Many things, apparently of minor importance, exert such a marked influence upon the results, that it is only by the greatest care in every particular, aided by experience and intelligence, that trustworthy tests can be made.

The test for tensile strength on a sectional area of one square inch is recommended, because, all things considered, it seems best for general use. In the small briquette there is less danger of air bubbles, the amount of material to be handled is smaller, and the machine for breaking may be lighter and less costly.

The tensile test, if properly made, is a good, though not a perfect indication of the value of a cement. The time requisite for making this test, whether applied to either the natural * or the Portland cements, is considerable (at least seven days, if a reasonably reliable indication is to be obtained), and as work is usually carried on, is frequently impracticable. For this reason short time tests are allowable in cases of necessity, though the most that can be done in such testing is to determine if the brand of cement is of its average quality. It is believed, however, that if a neat cement stands the one-day tensile test, and the tests for checking and for fineness, its safety for use will be sufficiently indicated in the case of a brand of good reputation; for, it being proved to be of average quality, it is fair to suppose that its subsequent condition will be what former experiments, to which it owes its reputation, indicate that it should be. It cannot be said that a new and untried cement will by the same tests be proved to be satisfactory; only a series of tests for a considerable period, and with a full dose of sand, will show the full value of any cement; and it would be safer to use a trustworthy brand, without applying any tests whatever, than to accept a new article which had been tested only as neat cement and for but one day.

The test for compressive strength is a very valuadle one in point of fact, but the appliances for crushing are usually somewhat cumbersome and expensive, so much so that it seems undesirable that both tests should be embodied in a uniform method proposed for general adoption. Where great interests are at stake, however, and large contracts for cement depend on the decision of an engineer as to quality, both tests should be used if the requisite appliances for making them are within reach. After the tensile strength has been obtained, the ends of the broken briquettes, reduced to one-inch cubes by grinding and rubbing, should be used to obtain the compressive strength.

The adhesive test being in a large measure variable and uncertain, and, therefore, untrustworthy, is not recommended.

FINENESS.

The strength of a cement depends greatly upon the fineness to which it is ground, especially when mixed with a large dose of sand. It is, therefore, recommended that the test be made with cement that has passed through a No. 100 sieve (10,000 meshes to the square inch), made of No. 40 wire, Stubbs's wire gauge. The results thus obtained will indicate the grade which the cement can attain, under the condition that it is finely ground, but it does not show whether or not a given cement offered for sale shall be accepted and used. The determination of this question requires that the tests should also be applied to the cement as found in the market. Its quality may be so high that it will stand the tests even if very coarse and granular, and, on the other hand, it may be so low that no amount of pulverization can redeem it. In other words, fineness is no sure indication of the value of a cement, although all cements are improved by fine grinding. Cement of the better grades is now usually ground so fine that only from 5 to 10 per cent. is rejected by a sieve of 2,500 meshes per square inch, and it has been so fine that only from 3 to 10 per cent. is rejected by a sieve of 32,000 meshes per square inch. The finer the cement, if otherwise good, the larger dose of sand it will take, and the greater its value.

CHECKING OR CRACKING.

The test for checking or cracking is an important one, and, though simple, should never be omitted. It is as follows:—

* Where the word "natural" is used in this connection, it is to be understood as being applied to the lightly burned natural American or foreign cements, in contradiatinction to the more heavily burned Portland cement, either natural or artificial.

Make two cakes of neat cement 2 or 3 ins. in diameter, about ½ in. thick, with thin edges. Note the time in minutes that these cakes, when mixed with water to the consistency of a stiff plastic mortar, take to set hard enough to stand the wire test recommended by General Gilmore, $\frac{1}{12}$ in. diameter wire loaded with ¼ of a lb., and $\frac{1}{24}$ in. loaded with 1 lb. One of these cakes, when hard enough, should be put in water, and examined from day to day to see if it becomes contorted, or if cracks show themselves at the edges, such contortions or cracks indicating that the cement is unfit for use at that time. In some cases the tendency to crack, if caused by the presence of too much unslacked lime, will disappear with age. The remaining cake should be kept in the air and its color observed, which for a good cement should be uniform throughout, yellowish blotches indicating a poor quality; the Portland cements being of a bluish gray, and the natural cements being light or dark, according to the character of the rock of which they are made. The color of the cements when left in the air indicates the quality much better than when they are put in water.

TESTS RECOMMENDED.

It is recommended that tests for hydraulic cement be confined to methods for determining fineness, liability to checking or cracking, and tensile strength; and for the latter, for tests of seven days and upward, that a mixture of 1 part of cement to 1 part of sand for natural cements, and 3 parts of sand for Portland cements, be used, in addition to trials of the neat cement. The quantities used in the mixture should be determined by weight.

The tests should be applied to the cements as offered for sale. If satisfactory results are obtained with a full dose of sand, the trials need go no further. If not, the coarser particles should first be excluded by using a No. 100 sieve, in order to determine approximately the grade the cement would take if ground fine, for fineness is always attainable, while inherent merit may not be.

MIXING, ETC.

The proportions of cement, sand, and water should be carefully determined by weight, the sand and cement mixed dry, and all the water added at once. The mixing must be rapid and thorough, and the mortar, which should be stiff and plastic, should be firmly pressed into the molds with the trowel, without ramming, and struck off level; the molds in each instance, while being charged and manipulated, to be laid directly on glass, slate, or some other non-absorbent material. The molding must be completed before incipient setting begins. As soon as the briquettes are hard enough to bear it, they should be taken from the molds and be kept covered with a damp cloth until they are immersed. For the sake of uniformity, the briquettes, both of neat cement and those containing sand, should be immersed in water at the end of twenty-four hours, except in the case of one-day tests.

Ordinary fresh, clean water, having a temperature between 60 and 70 degrees F., should be used for the water of mixture and immersion of samples.

The proportion of water required varies with the fineness, age, or other conditions of the cement, and the temperature of the air, but is approximately as follows:—

For briquettes of neat cement: Portland, about 25 per cent.; natural, about 30 per cent.

For briquettes of 1 part cement, 1 part sand; about 15 per cent. of total weight of sand and cement.

For briquettes of 1 part cement, 3 parts sand; about 12 per cent. of total weight of sand and cement.

The object is to produce the plasticity of rather stiff plasterer's mortar.

An average of five briquettes may be made for each test, only those breaking at the smallest section to be taken. The briquettes should always be put in the testing machine and broken immediately after being taken out of the water, and the temperature of the briquettes and of the testing room should be constant between 60 and 70 degrees F.

The stress should be applied to each briquette at a uniform rate of about 400 lbs. per minute, starting each time at 0. With a weak mixture one half the speed is recommended.

WEIGHT.

The relation of the weight of cement to its tensile strength is an uncertain one. In practical work, if used alone, it is of little value as a test, while in connection with the other tests recommended it is unnecessary, except when the relative bulk of equal weights of cement is desired.

We recommend that the cubic foot be substituted for the bushel as the standard unit, whenever it is thought best to use this test.

SETTING.

The rapidity with which a cement sets or loses its plasticity furnishes no indication of its ultimate strength. It simply shows its initial hydraulic activity.

For purposes of nomenclature, the various cements may be divided arbitrarily into two classes, namely: quick-setting, or those that set in less than half an hour; and slow-setting, or those requiring half an hour or more to set. The cement must be adapted to the work required, as no one cement is equally good for all purposes. In submarine work a quick-setting cement is often imperatively demanded, and no other will answer, while for work above the water-line less hydraulic activity will usually be preferred. Each individual case demands special treatment. The slow-setting natural elements should not become warm while setting, but the quick-setting ones may, to a moderate extent, within the degree producing cracks. Cracks in Portland cement indicate too much carbonate of lime, and in the Vicat cements too much lime in the original mixture.

NOTE.—Your committee thinks it useful to insert here a table showing the average minimum and maximum tensile strength per square inch which some good cements have attained when tested under the conditions specified elsewhere in this report. Within the limits given in the following table, the value of a cement varies closely with the tensile strength when tested with the full dose of sand.

American natural cement, neat: —
1 day, 1 hour or until set in air, the rest of the 24 hours in water, from 40 lbs. to 80 lbs.
1 week, 1 day in air, 6 days in water, from 60 lbs. to 100 lbs.
1 month (28 days), 1 day in air, 27 days in water, from 100 lbs. to 150 lbs.
1 year, 1 day in air, the remainder in water, from 300 lbs. to 400 lbs.

American and foreign Portland cements, neat: —
1 day, 1 hour, or until set, in air, the rest of the 24 hours in water, from 100 lbs. to 140 lbs.
1 week, 1 day in air, 6 days in water, from 250 lbs. to 550 lbs.
1 month (28 days), 1 day in air, 27 days in water, from 350 lbs. to 700 lbs.
1 year, 1 day in air, the remainder in water, from 450 lbs. to 800 lbs.

American natural cement, 1 part of cement to 1 part of sand: —
1 week, 1 day in air, 6 days in water, from 30 lbs. to 50 lbs.
1 month (28 days), 1 day in air, 27 days in water, from 50 lbs. to 80 lbs.
1 year, 1 day in air, the remainder in water, from 200 lbs. to 300 lbs.

American and foreign Portland cements, 1 part of cement to 3 parts of sand: —
1 week, 1 day in air, 6 days in water, from 80 lbs. to 125 lbs.
1 month (28 days), 1 day in air, 27 days in water, from 100 lbs. to 200 lbs.
1 year, 1 day in air, the remainder in water, from 200 lbs to 350 lbs.

Standards of minimum fineness and tensile strength for Portland cement, as given below, have been adopted in some foreign countries.

In Germany, by Berlin Society of Architects, Society of Manufacturers of Bricks, Lime, and Cement, Society of Contractors, and Society of German Cement Makers.

STANDARD OF 1877.

Fineness, not more than 25 per cent. to be left on sieve of 5,806 meshes per square inch.
Tensile strength, 1 part cement, 3 parts sand, 1 day in air, 27 days in water, 113.78 lbs. per square inch.

STANDARD OF 1878.

Fineness, not more than 20 per cent. to be left on sieve, as above.
Tensile strength, same mixture and time as above, 142.23 lbs. per square inch.
In Austria, by Austrian Association of Engineers and Architects.

STANDARD OF 1878.

Fineness, same as German of 1878.
Tensile strength, same mixture as above, 7 days, 1 day in air, 6 days in water, 113.78 lbs. per square inch.
28 days, 1 day in air, 27 days in water, 170.68 lbs. per square inch.
In Austria a standard for the minimum fineness and tensile strength of Roman cement was established and generally accepted, as follows: —

STANDARD OF 1878.

Fineness, same as Portland.
Tensile strength (1 part of cement, 3 parts of sand), for
Quick setting cement (taking 15 minutes or less to set): —
7 days, 1 day in air, 6 days in water, 23 lbs. per square inch.
28 days, 1 day in air, 27 days in water, 56.9 lbs. per square inch.
Slow setting cement (taking more than 15 minutes to set): —
7 days, 1 day in air, 6 days in water, 42.6 lbs. per square inch.
28 days, 1 day in air, 27 days in water, 85.3 lbs. per square inch.
The Roman cements correspond to those classified in this report under the head of natural cements.
Standards have been adopted also in Sweden and Russia.

SAMPLING.

There is no uniformity of practise among engineers as to the sampling of the cement to be tested, some testing every tenth barrel, others every fifth, and others still every barrel delivered. Usually, where cement has a good reputation, and is used in large masses, such as concrete in heavy foundations, or in the backing or hearting of thick walls, the testing of every fifth barrel seems to be sufficient; but in very important work, where the strength of each barrel may in a great measure determine the strength of that portion of the work where it is used, or in the thin walls of sewers, etc., etc., every barrel should be tested, one briquette being made from it.

In selecting cement for experimental purposes, take the samples from the interior of the original packages, at sufficient depth to insure a fair exponent of the quality, and store the same in tightly closed receptacles impervious to light or dampness until required for manipulation, when each sample of cement should be so thoroughly mixed, by sifting or otherwise, that it shall be uniform in character throughout its mass.

SIEVES.

For ascertaining the fineness of cement it will be convenient to use three sieves, viz.: —

No. 50 (2,500 meshes to the square inch), wire to be of No. 35 Stubbs's wire gauge.

No. 74 (5,476 meshes to the square inch), wire to be of No. 37 Stubbs's wire gauge.

No. 100 (10,000 meshes to the square inch), wire to be of No. 40 Stubbs's wire gauge.

The object is to determine by weight the percentage of each sample that is rejected by these sieves, with a view not only of furnishing the means of comparison between tests made of different cements by different observers, but indicating to the manufacturer the capacity of his cement for improvement in a direction always and easily within his reach. As already suggested in another connection, the tests for tensile strength should be applied to the cement as offered in the market, as well as to that portion of it which passes the No. 100 sieve.

For sand, two sieves are recommended, viz.: —

No. 20 (400 meshes to the square inch), wire to be of No. 28 Stubbs's wire gauge.

No. 30 (900 meshes to the square inch), wire to be of No. 31 Stubbs's wire gauge.

These sieves can be furnished in sets as follows, an arrangement having been made with a manufacturer of such articles, by which he agrees to furnish them of the best quality of brass wire cloth, set in metal frames, the cloth to be as true to count as it is possible to make it, and the wire to be of the required gauge. Each set will be enclosed in a box, the sieves being nested.

Set A, three cement sieves, to cost $4.80.

No. 100	7	ins. diameter.
No. 74	6½	" "
No. 50	6	" "

Set B, two sand sieves, to cost $4.

No. 30	8	ins. diameter.
No. 20	7½	" "

STANDARD SAND.

The question of a standard sand seems one of great importance, for it has been found that sands looking alike and sifted through the same sieves give results varying within rather wide limits.

The material that seems likely to give the best results is the crushed quartz used in the manufacture of sandpaper. It is a commercial product, made in large quantities and of standard grades, and can be furnished of a fairly uniform quality. It is clean and sharp, and although the present price is somewhat excessive (3 cents per pound), it is believed that it can be furnished in quantity for about $5 per barrel of 300 lbs. As it would be used for test only, for purposes of comparison with the local sands, and with tests of different cements, not much of it would be required. The price of the German standard sand is about $1.25 per 112 lbs., but the article being washed river sand is probably inferior to crushed quartz. Crushed granite could be furnished at a somewhat less rate than quartz, and crushed trap for about the same as granite, but no satisfactory estimate has been obtained for either of these.

The use of crushed quartz is recommended by your committee, the degree of fineness to be such that it will all pass a No. 20 sieve and be caught on a No. 30 sieve. Of the regular grade, from 15 to 37 per cent. of crushed quartz No. 3 passes a No. 30 sieve, and none of it passes a No. 50 sieve. As at present furnished, it would need resifting to bring it to the standard size, but if there were sufficient demand to warrant it, it

could undoubtedly be furnished of the size of grain required at little, if any, extra expense.

A bed of uniform, clean sand of the proper size of grain has not been found, and it is believed that to wash, dry, and sift any of the available sands would so greatly increase its cost that the product would not be much cheaper than the crushed quartz, and would be much inferior to it in sharpness and uniform hardness of particles.

MOLDS.

The molds furnished are usually of iron or brass, the price of the former being $2, and of the latter $3 each. Wooden molds, if well oiled to prevent their absorbing water, answer a good purpose for temporary use, but speedily become unfit for accurate work. A cheap, durable, accurate, and non-corrodible mold is much to be desired, but is not yet upon the market. Plates Nos. XLIV. and XLV. show the form of briquette and of metal mold recommended. It may be added that your committee are not in entire accord with respect to the merits of this form of briquette, its principal defect being that the rupture must take place at the neck or smallest section, whether the strain be one of extension only or otherwise. With a briquette of such form that oblique strains would usually produce rupture in oblique directions, the trials taking this character would be rejected, and the accuracy of the results correspondingly increased thereby.

CLIPS.

In using the clips recommended in the preliminary report, it was found in some instances that the specimens were broken at one of the points where they were held. This was undoubtedly caused by the insufficient surface of the clip, which, forming a blunt point, forced out the material. Where the specimens were sufficiently soft to allow this point to be imbedded, they broke at the smallest section, but when hard enough to resist such imbedding they showed a wedge-shaped fracture at the clips. To remedy this the point should be slightly flattened so as to allow of more metal surface in contact with the briquette. Clips made in this way have been used, and good results obtained.

To adapt the 1 in. clips of the Riehle machine only a slight amount of work is necessary; the ends being rounded, as shown in Plate No. XLVI., will admit the proposed new form of briquette, and yet not prevent the use of the old one, thus allowing comparative tests of the two forms to be made without changing the clips.

There should be a strengthening rib upon the outside of the clips, as shown in Plate No. XLVI., to prevent them from bending or breaking when the specimens are very strong.

The clips should be hung on pivots, so as to avoid, as much as possible, cross strain upon the briquettes.

MACHINES.

No special machine has been recommended, as those in common use are of good form for accurate work, if properly used, though in some cases they are needlessly strong and expensive. Machines with spring balances are to be avoided, as more liable to error than others.

It is by no means certain that there exists any great difference in well made machines of the standard forms given.

The experiments of the committee do not seem to justify an expression of preference for any one machine. Plates Nos. XLVII. and XLVIII. show three American machines, with the prices obtained from the manufacturers.

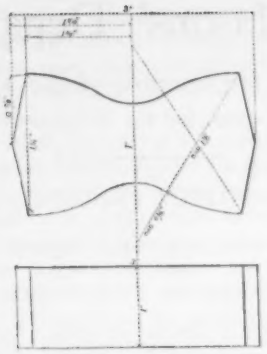
AMOUNT OF MATERIAL.

The amount of material needed for making five briquettes of the standard size recommended is, for the neat cements, about 1⅔ lbs., and for those with sand, in the proportion of 3 parts of sand to 1 of cement, about 1¼ lbs. of sand, and 6⅔ ozs. of cement.

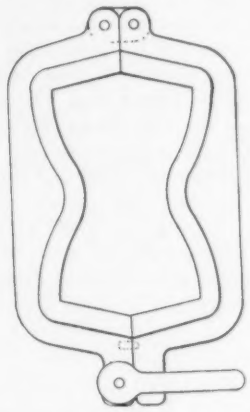
All of which is respectively submitted.

Q. A. GILLMORE,
Chairman.

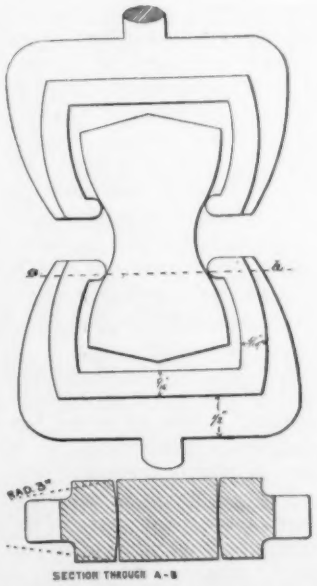
D. J. WHITTEMORE.
J. HERBERT SHEDD.
ELIOT C. CLARKE.
ALFRED NOBLE.
F. O. NORTON.
W. W. MACLAY.
LEONARD F. BECKWITH
THOS. C. MCCOLLOM.



DETAILS FOR BRIQUETTE.
Reduced to half size.
PLATE XLIV.
TRANSACTION AMERICAN SOCIETY CIVIL ENGINEERS. VOL. XIV. NO. 315.
REPORT ON A UNIFORM SYSTEM FOR TESTS OF CEMENT.



STANDARD FORM FOR MOLD.
Reduced to half size.
PLATE XLV.
TRANSACTION AMERICAN SOCIETY CIVIL ENGINEERS. VOL. XIV. NO. 315.
REPORT ON A UNIFORM SYSTEM FOR TESTS OF CEMENT.



STANDARD FORM FOR BRIQUETTE AND CLIPS.
Reduced to half size.
PLATE XLVI.
TRANSACTION AMERICAN SOCIETY CIVIL ENGINEERS. VOL. XIV. NO. 315.
REPORT ON A UNIFORM SYSTEM FOR TESTS OF CEMENT.

The Masons' Department.

Conducted in the Interests of the Mason and the Contractor for Brickwork.

THE ARCHITECT AND CONTRACTOR.

BY THOMAS A. FOX. (*Continued.*)

BUILDING CONTRACTS.

THE consideration of this subject opens a field which is, practically, inexhaustible, and the treatment of it in these columns must necessarily be confined to a brief summary of the most important points involved, but it is hoped by this means to show the necessity of a more complete and thorough understanding of the matter on the part of both architects and contractors, particularly the latter. While the architect, if his education has been thorough, may have a certain amount of theoretical and superficial knowledge bearing on this important branch of his professional duties, the contractor's information on such a matter is, from force of circumstances, somewhat limited. At the present time a large proportion of our most successful builders are men who actually started at the bottom of the ladder, first serving their time as apprentices, then as journeymen, and finally, by their superior ability and enterprise, rising to be foremen, and master builders. No training could be better than this to make a man competent to handle successfully the practical problems of the building trade, but at the same time it must be admitted that such training affords little opportunity or incentive for the consideration of what might be called the semi-legal side of the business of the contractor. But because a thorough understanding of this matter is so rarely found among architects and contractors, it is no reason why the matter should be overlooked; for while in work of any unusual magnitude it is always best to have the benefit of legal advice, it is a comparatively simple matter to master the principles involved in ordinary and every-day transactions, at least, so far as to know when it may be necessary to call in a professional adviser. There is a somewhat prevalent notion that a contract is something which cannot be understood or interpreted, much less executed, except by lawyers or men of superior intelligence. This idea is erroneous, for there is no need, in framing a contract, to use any terms which cannot be readily understood by any one having a common school education; in fact, if the words or language are obscure, there is good reason to believe the document is faulty and should not be executed without a careful and critical examination. The proper time to interpret a contract is before it is signed, not after it has been brought into court. It should be understood, however, that certain legal phrases which perhaps to an inexperienced person may seem incomprehensible have an advantage in having been used for so long a time that their exact meaning has been established both by usage and decisions by the courts, but such facts make it a simple matter, when one meets with such phrases, to determine exactly what their true meaning is.

It is important at the outset to call attention to the fact that while "the law does not seek to compel a man to do that which he cannot possibly perform," it does not protect him if he chooses to contract to do that which is impossible. In other words, if the court is called upon to interpret something which is implied in a contract, it will not compel a man to do that which is impossible; but if, on the other hand, a man fairly agrees to do something which proves to be impossible, he is the victim of his own folly, and cannot escape responsibility or damages. If the court makes the law, it is merciful; if it is to enforce a law which has been made for it, it is relentless and even cruel.

The importance of having for all building work a legally drawn contract in which the requirements on both sides are clearly set forth cannot be over-estimated. If the parties to such an agreement are honest, a document of this kind will tend to prevent disagreements and lawsuits, for honest people are usually willing to live up to their promises; while, on the other hand, if one or more of the parties concerned for some reason resort to the courts, a clear and valid contract will go a great way toward obtaining a just and equitable settlement.

There is an important point in connection with building contracts to which attention should be called, and which is often overlooked by the contractor, which is, that the general conditions which usually precede the specifications as well as the drawings are virtually a part of the contract, and as a matter of fact often carry greater obligations than many of the requirements of the contract itself. If the architect is inclined to resort to sharp practise, it is comparatively easy for him to introduce in some inconspicuous place in the general conditions demands upon contractor, which, if they have not been considered by him, may prove of serious consequence. It is, therefore, most important that the contractor, when figuring a piece of work, should read carefully all written or printed matter accompanying a set of drawings. This caution would seem unnecessary were it not for a fact that it is a common occurrence to see a contractor, particularly a sub-contractor, turn hurriedly over the pages of general conditions, which are likely to contain conditions of vital importance, without reading a single paragraph. It seems hardly necessary to call attention to the fact that the general contractor should make all sub-contracts dependent on the same conditions under which he is placed, but experience shows that this precaution is frequently overlooked.

In work of any magnitude, it is only fair that before handing in his estimate the contractor should know the conditions under which the work is to be carried on. Instances are constantly occurring where, after a bid has been accepted, the contractor is confronted by a contract which contains requirements he had no reason to believe he would be called upon to fulfil, and this method is often unjustly used to prevent the lowest bidder from receiving the work. The best and fairest way to overcome this difficulty is to have the proposal contract, general conditions, and bond, if one is to be required, printed with the specifications, which gives the contractor the opportunity to consider at one time all the obligations under which he will be required to execute the work, providing his proposal is accepted.

Before considering the matter in detail it is important to define the legal requirements of contracts in general. "A contract is an agreement between two or more persons to do or abstain from doing some definite thing or things." And its conditions may be divided into two classes, express or implied. In the first instance the terms are expressed, either in writing or verbally, at the time the agreement is made; in the second, as the terms are implied they are defined by law.

Expressed contracts may, therefore, be again divided into verbal and written agreements. The verbal contract is limited by the so-called statute of frauds to "work which is performed within one year from the making thereof," and as this restriction should limit the work done under this form to comparatively small and unimportant undertakings, it is unnecessary to consider it further than to call attention to the fact that this limitation exists and is good law, and that the elements of a verbal (or simple contract, as it is sometimes called) are the request, the consideration, and the promise. That is to say, there must be a request on the part of the employer that the work be done, or, if he accepts the benefit of the work, the request will be implied. But a request without a consideration being void, there must be something of value, however small, given by the employer to the employee, or there is no obligation on the part of the latter.

A written contract shows on its face the obligations it carries, and the conditions therein set forth will be interpreted and enforced by the courts without being qualified by oral testimony, which is rarely admitted for the purpose of qualifying a written agreement,

provided the claim of fraud is not introduced. It matters not what was the intention if it does not conform to the terms of the document. There is this distinction, even in written contracts, which should be noted. A written contract which is not sealed must have a consideration named, but if a seal is affixed the consideration may be omitted, such being the result of ancient legal fiction, which it is unnecessary to discuss here. But the seal has a further significance, for in England, and to some extent in this country, a contract with a corporation is not valid unless the signature of its legal representative is accompanied by the official seal. Although the seal is not always essential, it is of vital importance that a contractor, before concluding an agreement with a corporation, should be absolutely sure of two things. First, that the document has the signature of the legal representative of the contracting body; second, that the terms of the contract do not exceed the powers of the corporation. For instance, if a contract which is legally drawn in all other particulars calls for an expenditure of money in excess of that which a corporation or board was authorized to spend, in all ordinary cases the contractor has no claim beyond the sum authorized.

An implied contract is of such indefinite character that a concise definition of it can hardly be framed. A good example of an agreement of this class would be where a person sees work of which he accepts the benefit being done, on premises owned by him; in such a case an obligation on his part to pay for such work would be implied. It should be understood that the laws of the different States vary more or less in regard to contracts, as in all other legal matters, but the examples and conditions cited above are, as a general rule, universally accepted as good law. It is the intention in the following paper to consider in detail the different requirements of a building contract and define the obligations which each one carries, so far as they have been determined by the courts.

THE INDIVIDUAL RESPONSIBILITY OF THE CONTRACTOR.

BY D. B. GARNSEY.

IN considering those conditions by which the building contractor is surrounded, which obstruct the direct and profitable transaction of his business, the fact must be recognized that the contractor himself has become so imbued with the belief that individual interests are paramount to all others, and, except in remote degree, have no distinct relation to the interest of the community, that he fails to understand that his welfare and business success rest upon the conditions of the community, for which he is responsible.

The ability to profitably transact his business depends as much upon the conditions existing in the community in which that business is transacted as it does upon the individual efforts of the contractor; and his responsibility for the conditions prevailing in the community exist in exact ratio with his responsibility to his individual welfare. If the builder were isolated from the community — entirely independent — it is self-evident that his field of operation would be limited, and his range of success restricted; but being dependent upon his relation to and connection with the community, it is upon the fulfilment of the obligations thus entailed that his prosperity is based.

Being a factor in the community, it is imperative that the contractor perform the functions of his part with such fidelity to the justice of his every relationship that it will be impossible for him to be dealt with unjustly by any other part.

If the contractor fails to perform his part and his methods are unfair, it is manifest that he draws to himself others whose dealings are of a similar character, and therein becomes responsible for the perpetuation of damaging conditions in the community, and demonstrates that upon the individual depends the welfare of the whole.

The contractor has been so long in the habit of yielding point after point to those with whom his business is transacted, in order to obtain his contracts, that he fails to understand that each concession has given to the person to whom the concession was made a disproportionate share of the benefits of the relationship. Knowing that the contractor has been sufficiently unjust to his competitors to warrant the assumption, the person to whom concessions have been made has come to demand these concessions as a right, because experience has taught him that he has but to demand and the contractor will yield.

There is nothing illogical in the existence of damaging conditions in the building business, for they are the direct outgrowth of the lack-method system by which the business is generally conducted. There being virtually no legal control of methods of competition, the transaction of the building business upon a fair and honorable basis depends upon the sense of justice and moral obligation of those by whom it is transacted. Continued concession by the contractor of what he believes to be his rights results in blunting the sense of moral obligations that exists in business, and lowers the standard upon which the business is conducted. The effect upon those immediately concerned in building, of the abrogation of his rights by the individual, is to weaken the resisting power of all contractors in the community, and to increase their damage from the cupidity of the individual. The presence of these causes is clearly shown in the fact that contractors are perpetually complaining that competition (?) is conducted in a majority of cases under conditions so void of equity that profitable business is virtually an impossibility. Fair and honorable competition has been so diverted from its natural purposes by the illegitimate action of individuals that owners or architects having work to let may demand anything they wish from the contractor with almost a certainty of its being conceded. It is under such conditions as these, which are the direct outgrowth of ignorance and unscrupulousness, that contract after contract is let at prices and under requirements which seem prohibitive of profit to the contractor; and it is only fair to assume that contracts taken under such conditions must be fulfilled either at a loss to the contractor, or by such unfair practises as will enable him to make a profit.

Reputable contractors are continually being astonished at the prices for which work is taken, the variation between the highest and lowest bids being frequently as great as one third of the total cost of the work.

The cause of this state of affairs is self-evident, for the act of giving away his rights, by the contractor, affects every individual cumulatively, and therefore the community, until a point of depression is reached where profit is impossible, under existing methods of competition.

The integrity of the contracting business is disturbed by the practises of those whose greatest interest is the maintenance of that integrity. When one contractor unjustly yields a point or cuts a price, in order to secure a contract, his competitor is forced, in self-protection, to do the same; and these increasing concessions and increasing cuts in price react upon each other until the whole community of contractors is made to suffer from the effects of the cupidity of the individual.

The failure of the contractor to fulfil his responsibilities, and to protect himself, and therefore the community, against the inevitable damage of such courses is the primal cause of the chaotic condition of the competitive part of the building business.

Very elastic customs to the contrary notwithstanding, the contractor has no right to damage himself by unfair concessions, or by submitting to unjust requirements in order to obtain his contracts; for, being a part of the community, and in a measure dependent upon it, when he damages himself he damages every other member of the community. Generally stated, the contractor is solely to be blamed for the onerous conditions prevailing in his business, of which he complains; for constant submission invites continued and increasingly iniquitous requirements. To submit to unjust requirements is tantamount to an admission that such requirements are just.

Contractors must protect themselves from their competitors and from others before the conditions in the community will ever become protective; and it is self-evident that there is no protection in making the same concessions that the incapable and unscrupulous are compelled to make in order to secure work.

Recent Brick and Terra-Cotta Work in American Cities.

A Department Devoted to the Interests of the Manufacturer.

BUFFALO.—The Ellicott Square, with its ten stories of imposing Italian Renaissance, has taken front rank as one of the notable features of this city, and, occupying one entire square, may justly be called the largest, finest, and most complete office building in America.

The building derives its name from Joseph Ellicott, formerly agent of the Holland Land Company, who laid out the village of New Amsterdam, now Buffalo, and owned this square upon which the building now stands.

The building measures 204 by 200 ft., and 144 ft. high. It may be classified as a small town having a community of four to five thousand persons, while the building is said to be visited by no less than fifty thousand persons daily.

The building possesses many advantages and accommodations not found in smaller structures, whereby a tenant may obtain the highest degree of personal comfort and unsurpassed facilities for the prompt transaction of business.

Under the same roof can be found good banking accommodations, legal, architectural, and engineering advice, medical aid, dental service, life, accident, marine, and fire insurance, Turkish, Russian, and plain baths; cigars, newspapers, periodicals, stationery, postage stamps, a luxurious café, a more economical lunch counter, two very complete barber shops, and a law and reference library with librarian in charge.

The first floor has 16 ft. ceilings, being divided into forty stores devoted to diversified lines; the second floor has 14 ft. ceilings, and contains sixteen banks or counting rooms; the seven floors above are arranged into six hundred offices or studios, having telephone, messenger calls, wardrobes, marble wash-basins, and in every other office a vault, while in the halls are mailing chutes.

The tenth floor is divided between the Ellicott Club, organized by business men, and the general offices of the Western Union Telegraph Company.

In the center of the building is a large court, 110 by 70 ft. wide, with two grand stairways leading up to a balcony which encircles the court at level of banking floor, and having bronze railings of very pleasing designs.

The court is covered at the third story with opaque glass, providing abundance of light through the day, and illumined by two grand electroliers at night.

The vestibules are two stories high, joining the court at either side; both are faced with Italian marble, with floors of marble mosaic.

ELLICOTT SQUARE BUILDING, BUFFALO, N. Y.
D. H. Burnham & Co., Architects.

Architects of building, D. H. Burnham & Co.; general contractors, Jonathan Clark & Sons Co.

The exterior is treated in pearly gray brick with courses, entrance, and cornice of same colored terra-cotta, furnished by Perth Amboy Terra-Cotta Company.

Frame, steel; weight, 5,500 tons; Carnegie.

Fire-proofing, Pittsburg Terra-Cotta Company; 12,000 tons.

Foundations, steel and concrete, 19 ft. below grade, composed of six thousand barrels of Giant Portland Cement.

CHICAGO.— Quite a book might be written on the subject of "Signs in Relation to Commercial Architecture." When viewing the chaotic appearance of any part of the crowded business district, where signs of all sorts and sizes are seen in such confusion that no one of them is conspicuous, and good architectural design is completely hidden, one is forced to the conclusion that not enough consideration is given by designers of business buildings to the signs which necessarily must be displayed as soon as the building is occupied. Some of the later office buildings require their tenants to conform to certain rules, generally limiting them to display signs gilded on the glass. But for stores, shops, and factories, signs are usually an after-thought, whereas the architect ought to provide for them in such a manner that the building would not be disfigured by the advertising, even if he is not himself allowed to design the signs. Signs, by the way, as a study outside of any esthetic consideration, are quite a fad with some people. Some of the signs visible in Chicago are more appropriate than those of Mr. Waters and Mr. Coffee, who sell beer. A Mr. Hay keeps a feed store, Mr. Burns sells coal and wood, and Miss Wigfall has false hair for sale. One of the latest noticed by the writer is a 20 ft. sign on W. Madison Street,— "Babies reduced to $1.00 per dozen." There is no explanation except the character of the building, which indicates a photograph gallery within.

Labor Day, this year, saw a splendid parade of the union organizations. The estimated number of workingmen in line was twenty thousand, and it served as an impressive spectacle to remind the many thousand onlookers of the growing power of labor unions. The same motive dominates now that in ancient times led the silversmiths of Ephesus to mob Paul because he was interfering with the demand for silver Dianas. There is no record that anybody objected when Paul stopped preaching for a time and resumed his tent-making, but a Chicago preacher found himself brought up short a few days ago when he thought he would help build his own church, and temporarily resumed his old trade as a carpenter. The walking delegate ordered work stopped, and it did not go on until the minister left saw and hammer for his pastoral calls.

There are seven large buildings in Chicago in process of construction (all of which have been mentioned in this column previously), whose combined cost is estimated at $4,400,000. These keep building matters from seeming quite dead, but, nevertheless, the dulness is serious. The records show that the permits for buildings in August, 1896, were but little more than half those of August, 1895, whether measured by number, cost of buildings, or feet frontage.

The condition of the loan market has tied up many building projects.

Among the most important of minor buildings in progress are some fine residences designed by Wilson & Marshall.

Contracts have been let by Mr. Martin Carr for the erection of a $100,000 Catholic Church.

ST. LOUIS.— The Chemical Building on the corner of 8th and Olive Streets is rapidly nearing completion, and will soon be ready for occupancy. It contains no special features, other than those found in other first-class office buildings. It is seventeen stories high, in what Barr Ferre is pleased to call the degenerate Chicago style; its many angular bays and the numerous ornamental horizontal lines which mark the different stories suggest, to use a common expression, that the architect had found "a good thing," and was tempted to "push it along." He has left no quiet spot upon which we may rest the eye, and, although we may be awed by its great height, we find it lacks the impressive simplicity and imposing contour of its less pretentious neighbor, the Union Trust Building.

The architect has given us quite a surprise by the use of very dark red brick and terra-cotta, quite out of the ordinary in this day of lighter colors.

It is gratifying to see gray brick being employed more generally than heretofore with terra-cotta of the same color. There seems to be no better color, especially for down-town buildings, as it gives the appearance of solidity, and is defaced less by the smoke and dirt than any other color, and the excellent results obtained with it in residences in connection with lighter trimmings in stone or terra-cotta is being appreciated.

The Steifel Building, adjoining the Hagan Opera House on Pine Street, is also nearly completed. It is a six-story, fire-proof commercial building in which the gray brick have been used, but unfortunately, the full value of the color is not obtained on account of a light mortar having been used. The brick were furnished by the Hydraulic Press Brick Company of this city, and the terra-cotta by Evans & Howard.

The architect has not been very considerate with his style, for, although the general scheme of his façade is in the Renaissance, he has seen fit to decorate his window mullions with Gothic, while in the frieze he has paid tribute to Louis H. Sullivan by ornamenting his panels in such a manner as would be a credit to Mr. Sullivan himself.

Some few years ago one Mr. Fagin conceived the idea of putting up a building of an original design, and so well did he succeed that the building attracted attention far and near, if not for its beauty, at least for its striking originality, and a year or two ago it was severely criticized by the *Architectural Record*, under the head of "Architectural Aberrations." A few months ago the building was sold to the Burlington Building Company, who have remodeled the interior, making a first-class office building of it, and replaced the street front with a more consistent design in brick and terra-cotta. They have also renamed it the Burlington.

ENAMELED BRICK.

FOR exterior use in city architecture it would be difficult to name any material which combines more good qualities than enameled bricks. Durability, beauty, cleanliness are three important requisites, all of which are combined in the glazed bricks of best quality now being offered in this market. The Tiffany Pressed Brick Company, of Chicago, are making a very superior quality of enameled bricks, in which the enamel forms a complete and inseparable union with the body of the brick. The severest tests have proven that the enamel will stand for inside or outside work in any climate, and that it is practically indestructible by frost or heat. On the score of beauty these bricks are unexcelled. They are made in white, ivory, cream, buff, brown, chocolate, blue, green, granite, etc., and thus are readily adapted to any of the most elaborate schemes of ornamentation the architect may devise. Their shapes are also advantageous for this purpose, being of the English pattern, 9 by 3 by 4½ ins.; the American, 8¼ by 2¼ by 4 ins.; the Roman, 12 by 1½ by 4. In regular stock the company keep stretchers, quoins, octagon, round end, splay, and soaps. It can be readily understood that beautiful effects in fireplace, mantel, and chimney work may be produced with the various shapes and shades of these enameled bricks, and for outside work they offer endless possibilities in artistic combinations, which, with the aid of the architects' working plan, can be set by any experienced mason.

The consideration of cleanliness, especially in a city, is by no means of least importance. The grime which comes from years of contact with city soot is so repulsive that it is never creditable to architect or owner. There is just as much necessity for a building that "will wash" nowadays as for any other object of every-day use. Enameled brickwork, inside or out, is readily cleansed with the hose, if necessary, and when washed presents as good an appearance as when new.

As to quality, it is sufficient to say that the Tiffany enameled bricks are equal, if not superior, to the best of English manufacture. But the most remarkable item is the low cost at which they can be produced. It is said that they can successfully compete in price with plain terra-cotta. This important consideration should lead to their adoption for a great variety of uses. — *Inland Architect.*

FIRE IN THE OFFICE OF THE COLLIERY ENGINEER COMPANY, AT SCRANTON, PENN.

THE offices of the Colliery Engineer Company, proprietors of *The Colliery Engineer and Metal Miner*, *Home Study*, and the International Correspondence Schools, in the Coal Exchange Building, Scranton, Penn., were partially destroyed by fire on Sunday morning, August 30, 1896. Fortunately, the printing plant was in another building, and *The Colliery Engineer and Metal Miner* and *Home Study* will be delayed in publishing only a few days. The reserves of all instruction and question papers, drawing plates, and other supplies and stationery used in the schools were kept in another building; consequently there will be no delay in conducting the instruction in the schools. New quarters have been engaged in the Mears' Building, and everything is running as smoothly as though no fire had occurred.

WATCH THIS COLUMN FOR POINTERS.

THE POWHATAN CLAY MANUFACTURING COMPANY are supplying the brick for the new Princeton Library Building, Princeton, N. J.

WALDO BROTHERS are furnishing Hoffman Cement on the Boston & Albany Railroad work at Newton. About twenty-five thousand barrels will be used.

WALDO BROTHERS are furnishing Alsen Portland Cement on city work at Woonsocket, R. I., notwithstanding the fact that the price was the highest submitted.

THE "Brooklyn Bridge Brand" of Rosendale Hydraulic cement will be used in building the new Syndicate Building, on Park Row, opposite the Astor House, New York City. R. H. Robertson is the architect, Dorson & Archer, masons.

THE UNION AKRON CEMENT COMPANY, Buffalo, N. Y., are furnishing the cement for concrete and foundation for paving two streets in Gloversville, N. Y., and also for similar work at Detroit, Mich. Their cement is also being used in foundation and brickwork for two large school buildings at Salem, Ohio.

THE RALSTON BRICK COMPANY, Ralston, Penn., manufacturers of buff, mottled, and fancy brick in all shades and colors, report a business which taxes the entire capacity of their plant. The clay from which their bricks are made is of an exceptionally fine quality, and the company, alive to the demands of the better class of architects, is producing bricks that are in every way first class.

THE POWHATAN CLAY MANUFACTURING COMPANY'S cream-white bricks, Roman shape, are being supplied to D. M. Lea for nine residences on Kenesaw Avenue, Washington, and their standard size for a new residence at Somerville, Mass., Enrico Tassanari, Esq., owner. They are also furnishing forty thousand granite-colored bricks to J. E. Cox, Esq., for his new residence at High Point, North Carolina.

THE agency in New England for the "Puzzolan" brand of German cement, made by H. H. Meier & Co., has been placed with Waldo Brothers.

This cement is being used largely in connection with light limestone to avoid stains and discolorations. It was used on Edison Electric Light Company's Building at Atlantic Avenue, and is being used on all face work on the new Hotel Touraine, Boylston and Tremont Streets, Winslow & Wetherell, architects.

THE roofing tile made by the Celadon Terra-Cotta Company, Charles T. Harris, lessee, will be used on the following buildings now being erected: —

Residence for George Willard, Chicago, Postle Bros., architects. Residence for L. A. Carton, Chicago, W. A. Otis, architect. Residence for J. A. Cummings, Chicago, A. J. Hussander, architect. Residence for Mr. Erisman, Philadelphia, T. P. Lonsdale, architect. Coach house for Jacob Kaufmann, St. Louis, Link & Rosenheim, architects. Station for Erie Railway Company, Alfred, N. Y., G. E. Archer, architect. Holy Angels' Church, Chicago, J. J. Egan, architect.

THE Perth Amboy Terra-Cotta Company will furnish the architectural terra-cotta on the following buildings, now under construction: —

Sprague residence courtyard, Brookline, Mass., Little, Brown & Moore, architects. Apartment house, 308 East 121st Street, New York, Schneider & Herter, architects. Residence at York, Pennsylvania, J. A. Dempwolf, architect. Stewart Building, Dorchester, Mass., L. C. Greenleaf, architect. Newton Bank, Newton, Mass. Wm. Gibbons Preston, architect. Residence for G. W. Childs Drexel, Bryn Mawr, Penn., Peabody & Stearns, architects. St. John's Home for Boys, Brooklyn, N. Y., R. L. Daus, architect. Forney School, Harrisburg, Penn., Miller & Kast, architects. Salvage Corps Station No. 2, Brooklyn, N. Y., R. L. Daus, architect.

THE TIFFANY PRESSED BRICK COMPANY, Chicago, are furnishing the enameled brick which is being used in the following buildings: —

Illinois Central Suburban Depot, lake front, Chicago, Ill., Francis T. Bacon, architect. Pennsylvania Railroad Depot, Columbus, O., D. H. Burnham & Co., architects. Stewart Building, northwest corner Washington and State Streets, Chicago, Ill., D. H. Burnham & Co., architects. Auburn State's Prison, Auburn, N. Y. Fourth Precinct Police Station, Cleveland, O., Wm. W. Sabin, architect. Washburn Memorial Home, Minneapolis, Minn. E. Smeeth Estate Building, Chicago, Ill., enameled brick for front, D. E. & O. H. Postle, architects. Toledo & Ann Arbor Railroad Depot, Toledo, O., W. T. Cooper, architect.

THE MARSH METALLIC CORNER BEAD is fast recommending itself to general use as a reliable and efficient corner-plate, which supplies ample clinching spaces for the mortar to bend around the corner and unite the two sides of the plastering. This bead consists of a rod of steel held rigidly at any required distance from the corner to be protected. Longitudinal depressions on the sides receive the mortar and furnish a grip for a metallic holder or clip. They also give the plaster a substantial thickness to its extreme edge and prevent the crumbling incident to a feather edge. As all parts are galvanized, this bead can be used with artificial plasters as well as with lime mortar. The corner when finished presents a smooth, rounded surface for paper or decoration. Different forms of clip enable this bead to be used as readily on the corners of brick and terra-cotta partition walls and of fire-proof construction as on wood studding.

THE "Columbus Brick" made by the Columbus Brick and Terra-Cotta Company, Union Furnace, Ohio, have been specified in the following buildings now under construction: —

Library Building, Princeton University, Princeton, N. J. (Gray Roman), W. A. Potter, New York, architect. Flats and stores for Wm. B. Hamilton, Lenox Avenue and 115th Street, New York (Gray Roman), Neville & Bagge, New York, architects. The Westinghouse "Club House," Wilmerding, Penn. (Gray Roman). The Yerkes Observatory for Chicago University, Williams Bay, Wis. (Gray Roman), Henry Ives Cobb, Chicago, architect. The Wattles Residence and barn, Omaha, Neb. (Gray Roman), Walker & Kimball, Omaha, architects. Dormitory for Smith's College, Northampton, Mass. (Dark Buff Normans), Scott & Edelsvard, New York, architects. Union Congregational Church, Worcester, Mass. (Dark Buff Roman), Earle & Fisher, architects. Flats and stores for John Flanagan & Son, Amsterdam Avenue and 110th Street, New York (Terra-Cotta Roman), G. A. Shellenger, architect. The Hartford Life and Annuity Building, Hartford, Conn. (Light Buff Standard), F. R. Comstock, architect. Government Building, Rock Island, Ill.

(Terra-Cotta Standard). The Secor Building, Toledo, O. (Light Gray Standard), E. O. Fallis & Co., Toledo, architects. The Coghlin Building, Toledo, O. (Light Gray Standard), David L. Stine, architect. St. Francis Church, Columbus, O. (Rock-Faced Gray Standard), Yost & Packard, Columbus, architects. Central Ohio Paper Company's Building, Columbus, O. (Gray Standard), H. A. Linthwaite, architect. Residence for W. G. Bush, Nashville, Tenn. (Light Buff Standard). Ninth Avenue Public School Building, Columbus, O. (Gray Standard), David Riebel, architect. Residence for J. C. Treadwell, Kingston, N. Y. (Gray Roman), A. F. Mason, architect. The "Garrett," Toledo (Speckled Brick).

CONSOLIDATION OF TWO IMMENSE CONCERNS.

WE would announce to our readers the consolidation of the two clay-working machinery manufacturing concerns heretofore known as The Frey-Sheckler Company, of Bucyrus, Ohio, and J. W. Penfield & Son, of Willoughby, Ohio. This has been accomplished by the formation of a new corporation, namely, the American Clay-Working Machinery Company, with a capital stock of $600,000. To this new corporation has been sold the machinery manufacturing plants, patterns, patents, and good-will of both concerns, both of whom thus virtually retire from the machinery manufacturing business. The arrangement is not in any sense a pool or trust; on the contrary, the sale and conveyance of the two plants is absolute and the new company will hereafter be vested with the entire properties and good-will of both the old ones. The objects leading to this change in form of organization were to set into operation superior methods and greater facilities for producing and marketing the highest grade of clay-working machinery with the greatest economy of time, effort, and expense, thereby making it possible to place upon the market a superior quality of machinery at the lowest price consistent with good workmanship, and yet secure a safe margin of profit. Furthermore, there was liability of expensive and annoying litigation between the two concerns, which is, of course, obviated by the new arrangement. The officers of the company are as follows: President, J. W. Penfield; First Vice-President, R. C. Penfield; Second Vice-President, C. W. Fisher; Secretary, W. W. Reehl; Treasurer, J. B. Gormly; General Manager, W. C. Lemert. The general offices of the company will be located at Bucyrus, Ohio. The several departments of the two companies will be merged and the list of machinery produced will comprise all of the lines formerly made by the individual concerns. By this consolidation of interests, there is formed one of the largest, most valuable, and best equipped enterprises of the kind in the world, both as to personnel, manufacturing facilities, and equipments, patents owned and controlled, and variety of clay-working machines and appliances produced.

The new firm states that the prices of machinery will not be advanced, but as above indicated, competition will be met by improved methods of manufacturing and selling the goods, and by the consequent greater economy in cost thus made possible, as well as by the excellence in quality of the goods produced. The lines of machinery produced by the new firm embrace nearly every conceivable form of clay-manipulating appliances, which, together with the company's resources and facilities, will enable it to fully equip any clay-working establishment, whether large or small, with a complete and perfect outfit entirely suited to its requirements, and at a reasonable price. It will be the policy of the new company to leave no stone unturned to keep fully abreast of the times in every respect, and to continue to be in a position to fully anticipate and meet the requirements of the trade, both by the quality and price of its goods and by its methods of dealing.

All correspondence with reference to new machinery or relating to the business of the new company should be addressed to the American Clay Working Machinery Company, Bucyrus, Ohio. For the present, however, correspondence with reference to repairs for machinery originally shipped from Willoughby should be addressed to the American Clay Working Machinery Company, Willoughby, Ohio. Correspondence relating to repairs for machinery originally shipped from Bucyrus should be addressed to the general offices at that place. The clay-testing department of the company is located at Bucyrus, and all clays to be tested should be forwarded to that point. All unfilled contracts for machinery or goods will be executed by the old concerns.